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ARTICLES TO APPEAR SOON

Washburne, Carleton W. "EDUCATIONAL MEASUREMENT AS A KEY TO INDIVIDUAL INSTRUCTION AND PROMOTION."

Knight, E. B. "QUALITIES RELATED TO SUCCESS IN ELEMENTARY SCHOOL TEACHING."

Henmon, V. A. C. and Streitz, Ruth. "A COMPARATIVE STUDY OF FOUR GROUP SCALES FOR THE PRIMARY GRADES."

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JOURNAL *of* EDUCATIONAL RESEARCH

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ARITHMETIC ABILITY OF MEN IN THE ARMY AND OF CHILDREN IN THE PUBLIC SCHOOLS[1]

ARTHUR KOLSTAD

State Normal School, Bellingham, Washington

When psychological examining in the army offered an opportunity to study the arithmetic ability of adult men through the scores made on Test 2 of the Alpha Group Examination, it was thought that a comparison of these scores with the results from giving the same test to children in the public school might contribute something to the problem of setting an ultimate standard for achievement in arithmetic in the grade schools, a problem which has been the subject of many investigations and studies. An arithmetic test has perhaps never been given to so large a group of adult men before.

It ought not to be necessary to describe the psychological examining in the army. This has been done in current magazines, as well as in the book, *Army Mental Tests*, edited by Majors C. S Yoakum and R. M. Yerkes.[2]

In order to examine the relation between scores received in arithmetic and amount of school education, the records of 2,500 random cases of drafted men were examined. These cases may be considered as typical of a much larger group, namely, the men from Washington, Oregon, Idaho, Montana, Wyoming, Utah, North Dakota, South Dakota, Minnesota, Nevada, and California—the states which contributed men to Camp Lewis, Washington. Moreover, the birthplaces of these men were in practically every state in the Union, and many of them had fairly recently moved to the above named states. In a sense, therefore, they can be said to represent the whole country.

[1] The writer wishes to acknowledge his indebtedness to Professor Clifford Woody, University of Michigan, for suggestions and encouragement in making this study.

[2] Yoakum, C. S. and Yerkes, R. M. *Army mental tests.* New York: Henry Holt and Company, 1920. 303 pp.

In order to compare the arithmetic ability of elementary-school children with that of mature men, Test 2 of the Alpha Scale was given to 632 children in the grades IV-B to VIII-A, inclusive, according to the directions given in the Examiner's Guide furnished the Psychological Examiners by the Surgeon General's Office. The children tested were of the Gatewood School, Seattle, the Sehome and Franklin schools, Bellingham, and the Training School at the Bellingham State Normal.[2] The test was also given to a class of third-grade children, but a number of the scores were "one" and "zero," indicating that the test was too difficult for them. These third-grade records were therefore disregarded.

For further comparison, the Alpha examination was given to 424 first-year students and 301 second-year students at the Washington State Normal School, Bellingham. The majority of these students were tested during the first part of the spring quarter; the rest were tested during the summer quarter. The summer group contained perhaps a greater percent of mature students than did the spring group, but not enough to affect the results materially.

The data used in answering the questions raised in the latter part of the discussion were gathered from the Alpha Group Examination blanks of enlisted men and officers. The scores of the enlisted men were in all cases those of unselected groups. The scores of the officers were chosen in several instances, because certain of their statements on the information blanks were thought to be more reliable than those of the enlisted men.

A few discrepancies may have crept in, but on the whole the information may be considered accurate, for it was given under military command, and the importance of care in answering the questions was fully realized by the men.

Arithmetic Ability and Schooling of Army Men

Table I and its graphical representation, Figure 1, showing for the 2,500 men the distribution of scores (i.e., the number of problems right) according to the school year they had passed, reveals a steady increase in arithmetic ability from grade two upward until the senior year of the high school is reached. There

[2] The writer wishes to express to the principals and teachers of these schools his deep appreciation of their willing cooperation.

seems to be little difference between those who have done one, two, or three years of college work. The college graduate seems to have an advantage over the non-graduate. The drop from a median score of 6.5 for those who had no schooling to a median score of 2.5 for those who dropped out of school after passing the second grade might be explained by saying that the latter group consisted of school misfits, who had no interest in acquiring any arithmetic ability later in life. The number of cases for these groups is too small, however, to be considered very reliable.

TABLE I. ARITHMETIC SCORES OF 2,500 ARMY MEN ACCORDING TO SCHOOLING

School Grade Passed	Arithmetic Score		Number of cases	School Grade Passed	Arithmetic Score		Number of Cases
	Mean	Median			Mean	Median	
Grade School				High School			
0	6.2	6.5	6	1	9.5	10.1	153
1	6.4	5.2	11	2	10.1	10.6	125
2	4.0	2.5	12	3	10.4	11.7	74
3	4.6	4.7	45	4	11.7	12.4	103
4	5.4	5.8	131	College	.....	.....	.....
5	6.0	6.6	223	1	11.2	12.2	48
6	6.5	6.8	280	2	11.8	12.3	42
7	6.9	7.5	376	3	11.9	12.0	36
8	8.5	8.9	797	4	13.2	13.5	32
.....	.....	.....	.....	5	14.0	14.5	6

The mean score on the arithmetic test for the 2,500 men was 8.09, which was 0.41 below the eighth-grade mean and 1.19 above the seventh-grade mean. The median score (8.62) was 1.12 above the seventh-grade median and 0.28 below the eighth-grade median.

The coefficient of correlation between the arithmetic score and the grade passed is $+0.571 \pm 0.009$, showing a definite relationship between the score received and the grade passed. The regression equation $y = 0.704x + 2.59$ yields a close agreement with the curve from the third to the twelfth grades. (x = year passed in school, continuing the count up from 8 for the high school

and beyond; $y =$ arithmetic score.) This equation indicates that for each additional grade passed above the third, one may expect an increase of seven-tenths of one point in arithmetic ability as measured by this test.

FIGURE 1. ARITHMETIC SCORES OF ARMY MEN ACCORDING TO SCHOOLING

Arithmetic Ability of School Children

An examination of Table II, giving the median and mean scores by grades for the 632 children who took the arithmetic test of the Alpha Scale shows a steady increase from IV-B to VIII-A, with the greatest changes from IV-B to IV-A, and from VII-A to VIII-B, and with practically no changes from IV-A to V-B, and from VIII-B to VIII-A. The greatest range of scores was found in VII-B, though the most uniform range was in VI-B.

TABLE II. ARITHMETIC SCORES OF 632 SCHOOL CHILDREN

Grade	Arithmetic Score		Number of Cases
	Mean	Median	
IV-B	3.8	4.25	37
IV-A	5.0	5.8	76
V-B	5.5	5.8	44
V-A	5.8	6.5	56
VI-B	6.3	7.0	64
VI-A	7.2	8.0	67
VII-B	7.5	8.35	69
VII-A	7.7	8.5	82
VIII-B	8.8	9.7	58
VIII-A	9.3	9.8	79

The coefficient of correlation between the school grade and the arithmetic score for the 632 children is $+0.578 \pm 0.018$, almost the same as was found for the men in the army, which was $+0.571$. The regression equation, $y = 1.06x + 0.66$ when compared with the equation for the army men ($y = 0.704x + 2.59$) shows that for the lower grades the army men have the higher scores, but that the increase in arithmetic ability per grade is greater for the school children, the relation of the increases being as 1.06 is to 0.704. The same difference is distinctly shown in Figure 2, which presents the graphs for both distributions. The equation also indicates that in general, for each advance of one grade, the arithmetic ability as here measured increases by 1.06 points, or, in other words, that pupil A, one grade beyond pupil B, ought to be able to work fully one problem more than pupil B.

From the above comparison of the two regression equations and from a comparison of the two graphs, the following conclusions may be drawn.

1. The individual who leaves school before reaching the sixth grade will add to his ability to solve arithmetic problems. The lower the grade he fails to complete, the greater is the increase in ability above what he possessed at the time of leaving

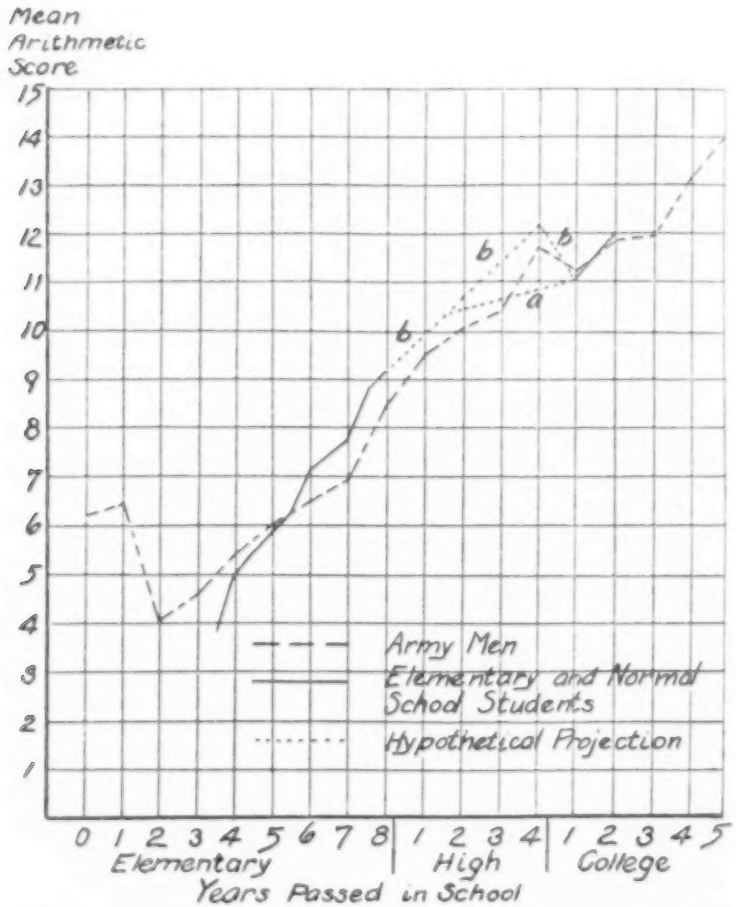

FIGURE 2. COMPARISON OF THE ARITHMETIC ABILITIES OF ARMY MEN WITH THAT OF SCHOOL CHILDREN ACCORDING TO GRADE PASSED

school, if we consider only those men who are literate according to the army definition. The relatively high scores made by men who had no schooling or but one year may be explained by supposing this group, relatively a small one, to be composed of persons who might be termed "self-educated" and self-confident, inasmuch as they did not hesitate to remain with the larger group at the time of examination, when those who had not passed the fifth grade or had not had the equivalent of a fifth-grade education were asked to step aside.

2. The individuals who complete the VI-B grade will have in later life approximately the same arithmetic ability as they had at the time of leaving school.

3. Those who go beyond the VI-B grade (within the elementary school) will in later life lose some of their schooltime proficiency, from 8.6 percent to 10.4 percent of what they had at the time of leaving school.

4. Since the two curves (Figure 2) are practically parallel from grades VI-VIII, the adult who completed the eighth grade has retained as much more ability than the one who completed but the seventh grade, as he originally added to his ability during the year spent in the eighth grade.

How far beyond the eighth grade the curve for school children would remain above the curve for adults if data had been collected for high-school pupils, cannot be definitely stated. The Alpha examination, however, was given to 424 juniors (first-year students) and 301 seniors (second-year students) at the Washington State Normal School, Bellingham. The following averages were obtained for Test 2: juniors, median = 11.67, mean = 11.04; seniors, median = 12.46, mean = 12.01. These mean scores may be compared with the mean scores for enlisted men who had completed one and two years of college work.[4]

The comparison shows that the one-college-year men made 0.16 point more than the normal-school juniors, while the normal-school seniors made 0.21 more than the two-college-years men. In Figure 2 this condition for the normal-school students is shown by the fragment of the full-line curve lying between "College 1" and "College 2." The problem now is to join this fragment to the curve representing the performance of pupils of the elementary

[4] In the army testing men were listed as having done college work if they had attended any institution having high-school graduation as an entrance requirement.

school. Two constructions are possible (besides others intermediate between them). First, if the schooltime arithmetic ability of the normal-school students can be considered superior to that of high-school seniors, the connecting curve would probably continue to parallel the army curve until about the second high-school year and would then intersect the army curve between the third and fourth high-school years. The course which the connecting curve would take according to this supposition is marked *a* in Figure 2. Second, if on the contrary the ability of high-school seniors can be considered greater than that of normal-school juniors, as it is for the army men, the connecting curve might extend upwards to the fourth year of the high school and then drop abruptly (as does the army curve) to the first college year. This alternative is represented in Figure 2 by the connecting curve marked *b*. A reasonable conclusion might be: The individual who leaves school anywhere from the sixth grade to the third—or perhaps fourth—year of the high school may expect to lose some of the ability for solving arithmetic statement problems that he had gained while in school.

Arithmetic Scores and Age of Subjects

One question presents itself in reviewing the arithmetic ability of mature men: Is there any definite consistent relationship between scores made and the ages of the subjects tested, which might color the interpretation of the results given above? In order to answer this question the arithmetic scores of the 424 normal-school juniors and the 301 seniors were distributed according to age. For the juniors there were so few cases in each year above 26 that these were all combined in one interval—"over 26." All the seniors above 27 were likewise put in one group.

An examination of the median scores for each year reveals a steady increase for the juniors from age 18 to age 22. Yet the differences are very small, and when viewed in the light of the range of scores within each age group (year 18,6 to 19; year 20,3 to 18; etc.) they are of little importance. The variation in the median scores for the seniors is greater with very little tendency towards uniformity. The distribution of students according to age is also less regular indicating that a greater number of factors influence the time and age at which senior students continue their studies.

TABLE III. ARITHMETIC SCORE FOR NORMAL-SCHOOL STUDENTS

Age	Juniors		Seniors		Juniors and Seniors Median
	Median	Number of Cases	Median	Number of Cases	
15	10.5	2	.....	.....	10.5
16	11.5	10	.....	.....	11.5
17	11.5	64	10.5	4	11.8
18	11.2	90	10.5	11	11.15
19	11.5	73	11.1	21	11.3
20	11.6	62	13.25	38	12.3
21	11.75	31	12.4	34	12.2
22	11.9	16	13.3	45	12.4
23	11.25	15	13.4	34	11.9
24	12.5	6	12.3	23	12.7
25	12.5	4	12.3	26	12.4
26	12.8	10	13.0	9	12.85
27	12.0[a]	41[a]	12.8	8	12.8[a]
over 27	.....	.....	12.85	48	.....

[a] These entries are for students over 26 years of age.

If age influences but little the distribution of the arithmetic scores of students actually in school, would it not have less influence in the case of individuals who have been out of school for some time? Would not numerous other factors tend to counteract this age influence, if it does exist?

Arithmetic Ability and Army Rank

The arithmetic scores of 532 officers were distributed according to rank, with mean and median results as shown in Table IV.

The mean and the median scores for each rank vary but little. Judged by the "number right" the second lieutenants seem to have greatest arithmetic ability, the captains the least, and the majors and first lieutenants about the same. The distributions—which are not here reproduced—indicate more centralized scores for the majors and captains. The majors appear to be somewhat more accurate than the other groups.

Success in advancement as commissioned officers does not seem to be correlative with ability to solve arithmetic problems,

but an examination of the errors made indicates a fairly steady decline from the number made by second lieutenants to the number made by majors. This suggests a slight correspondence between rank and accuracy, although there are notable exceptions.

TABLE IV. ARITHMETIC SCORES AND ARMY RANK

	Number Right		Number Wrong		Number of Cases
	Mean	Median	Mean	Median	
Majors.....	11.9	12.4	1.58	2.1	24
Captains....	11.6	11.9	2.13	2.4	136
First lieut...	11.9	12.5	2.10	2.1	242
Second lieut.	12.6	12.9	2.19	2.3	131
VIII-A grade children....	9.3	9.8	2.49	2.47	79

A comparison of the scores of the children in the VIII-A grade shows how far below the officers' scores they are. Remembering that the arithmetic ability of the men who had only finished the eighth grade is somewhat below that of the children actually in that grade, one can readily see that success as an army officer is accompanied by an ability above that reached in the grade schools. It is more nearly equal to the ability of the men who have graduated from high school.

Arithmetic Ability and Branch of Army Service

Figure 3 represents the mean arithmetic scores of 532 officers distributed according to the arm of the service to which each belonged.

Excluding those officer groups whose frequency is less than twelve, the following is the ranking in arithmetic ability based on the mean number of problems right: (1) field artillery; (2) signal corps; (3) infantry; (4) chaplains; (5) quarter masters' corps; (6) medical; (7) dental. If the median were used the order would be: (1) field artillery; (2) chaplains; (3) signal corps; (4) infantry; (5) quarter masters' corps; (6) dental; (7) medical.

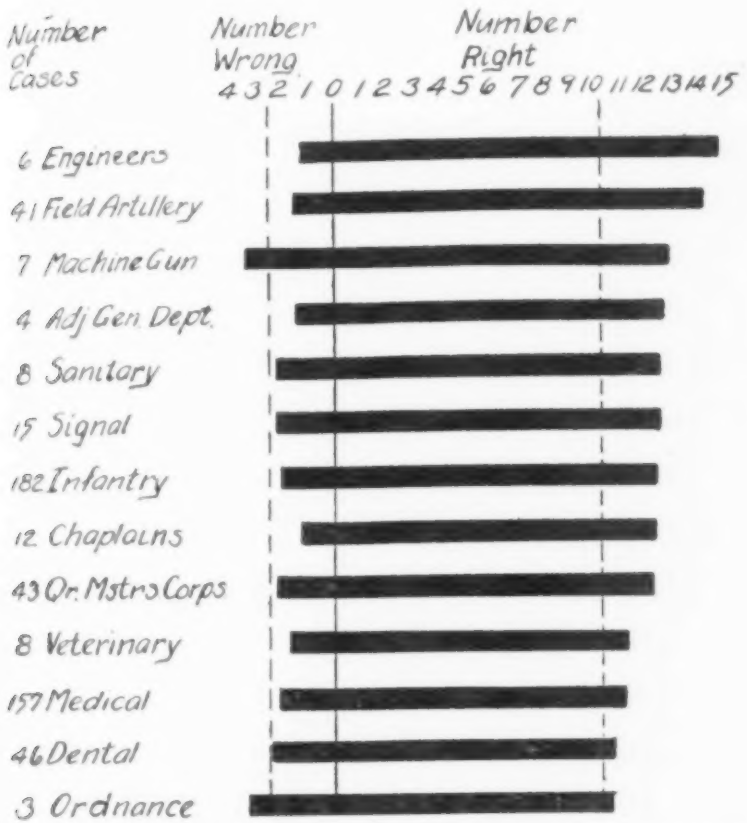

FIGURE 3. ARITHMETIC SCORES OF ARMY OFFICERS. (DASHED LINE SHOWS POSITION OF MEAN FOR CHILDREN OF THE 8A GRADE)

Here again a comparison of these scores with the scores of the VIII-A grade children reveals that the children have not secured the proficiency necessary for being Army officers in the various lines of service discussed. The dashed lines on Figure 3 representing the VIII-A performance bring out the fact that elementary-school graduates have considerably less ability than most officer groups and are considerably below those for all officer groups except "Ordnance." It is true that some of the eighth-grade children have an arithmetic ability equalling, and in a number of instances, surpassing the arithmetic ability of some of the officers.

But in terms of averages there is a considerable difference between all but the lowest officer groups on the one hand and eighth-grade pupils on the other hand.

Arithmetic Ability and Pre-War Occupation

It is generally conceded that all occupations do not require the same arithmetic ability, and that there are occupations in which the solving of arithmetic problems seldom occurs. But which occupations require this ability, which offer opportunity for continued use of this ability? These questions cannot be answered definitely here, but the distribution of arithmetic scores of 417 officers according to their pre-war occupations may be suggestive. All occupational groups with less than seven men were eliminated from this comparison. It must be remembered, however, that these figures are no more reliable than similar figures derived from occupational groups of seven or more persons each, who have been brought together without reference to their ability in arithmetic.

Table V gives the mean number of problems solved correctly, the mean number of problems solved incorrectly, the percent of accuracy (being the number right divided by the sum of the number right and the number wrong), and the number of officers in each group. The occupations are ranked according to mean number correct. As is readily noted, there is practically no relationship between the number right and the percent of accuracy; one group (merchant) which fell relatively low in "number right" has the next to the highest accuracy index (90.4), a case of "slow but accurate." Again "banking" ranks seventh in accuracy but sixteenth in number right. "Teacher" comes ninth in correct solutions but eighteenth, the lowest of these groups, in accuracy. On the whole, as one would expect, the scores correspond with the occupations ordinarily thought of as requiring ability to solve arithmetic problems. There are a few unexplained rankings, however. Should not "merchant" and "banking" groups rank above the thirteenth and sixteenth positions? Why does "clergyman" have such a high ranking both as to solutions and accuracy? The reader will no doubt have some answer in the light of his own observations. Any answer attempted here would have no greater significance.

Might this distribution point to the need of directly measuring the arithmetic ability of large numbers of men—and women—in the various occupations, to determine the amount they have lost of their schooltime ability, or the amount they have gained through activity in a certain line of work?

The mean scores for the grade children indicate an arithmetic ability far below that which seems necessary for success in the occupations here listed. The cases here presented are probably

TABLE V. SCORES MADE ON ARITHMETIC TEST BY 417 OFFICERS ACCORDING TO PRE-WAR OCCUPATION

Pre-War Occupation	No. Right (Mean)	No. Wrong (Mean)	Accuracy Percent	Number in Group
Real estate and insurance	14.9	1.6	90.3	8
Business manager	14.1	2.25	86.2	16
Clergyman	13.7	1.2	91.9	12
Clerk	13.7	2.0	87.2	13
Engineer	13.5	1.6	89.4	27
Salesman	13.5	2.1	86.6	16
Lawyer	13.3	2.0	86.9	20
Student-college	13.2	1.7	88.6	31
Teacher	13.0	3.1	80.7	7
Chemist and pharmacist	12.9	1.75	88.0	8
Accountant	12.8	2.2	85.3	14
Farmer	12.8	2.4	84.2	13
Merchant	12.3	1.3	90.4	7
Surgeon	12.1	1.4	89.6	8
Physician	11.2	2.2	83.5	147
Banking	11.1	1.5	88.1	8
Soldier	10.8	2.3	82.4	37
Dentist	10.1	2.1	82.7	25
VIII-A Grade School Children	9.3	2.49	78.8	79

rather highly selected, however, as they were clerks, salesmen, etc., who were also good enough to become army officers. Hence it is probably not unreasonable to suppose that they were in general "successful" in their occupations.

It is true that a certain percent (about 30) of the VIII-A grade children and even a very few of the sixth- and seventh-grade pupils have reached an ability equal to the mean score of the lowest occupational group, that of "dentist." But should not

all eighth-grade graduates have an ability at least equal to that of the occupational group "real estate and insurance"? Or, if the reader considers this too high, should not the mean score for eighth-grade pupils equal the mean score for "clerks"? Or must those of our grade-school graduates who become clerks increase their arithmetic ability by nearly 49 percent after they leave school and begin work? Should they not rather reach such a point while in school so that they can lose some of this school-time ability, as the majority seem to do, and still have sufficient for the various ordinary occupations they may enter?

Summary of Conclusions

The "average" American literate man has an ability for solving arithmetic statement problems that compares favorably with that possessed by seventh-grade children. The mean score for the 2,500 men is about one-third of the distance from the mean for the VII-A children toward the mean for the VIII-B children. The adult median is slightly above the VII-A median.

There is a definite relationship between the school grade finished and one's ability in later adult life to solve arithmetic statement problems, which is especially marked for those who have not proceeded beyond the high school. This relationship between school grade and arithmetic score for mature men is very nearly equal to that for school children, as seen by the coefficients of correlation, $r = +0.571$ for the men, and $r = +0.578$ for the children.

The individual who leaves school before reaching the sixth grade will add to his ability to solve arithmetic statement problems; he who completes the VI-B grade will have in later life approximately the same ability as he had in school; he who leaves school anywhere from the sixth grade to the fourth year of the high school may expect to lose some of his schooltime proficiency in arithmetic. The instruction in arithmetic in the seventh and eighth grade does not seem to be as valuable relatively as that in the preceding grades; yet, the adult who finished the seventh or the eighth grade retains as much more of arithmetic ability than he who completed but the sixth or the seventh, respectively, as he acquired during the added year in school. The increase in ability during the eighth year exceeds that acquired during the seventh year, however. Has a point been reached in the sixth grade where the returns from instruction are less than

in preceding years? In other words, is the sixth grade the turning point in arithmetic instruction where the "law of diminishing returns" sets in?

Eighth-grade arithmetic ability is far below that which is seemingly required by army officers in all branches of service here discussed.

The arithmetic ability of eighth-grade graduates, either at the time of graduating or later in life, is seemingly not sufficient for success in some eighteen occupations listed in this study.

A small percent of the elementary-school pupils and of those army men who completed the eighth grade but did not continue their school studies, have reached the mean arithmetic scores made by the army officers and the various occupational groups; but, should not the majority, if not all, eighth-grade graduates have an arithmetic ability at least equalling, if not surpassing, the ability seemingly necessary for success in these occupations?

Since only 55 percent of the boys complete the eighth grade and only 23 percent continue into high school, the arithmetic instruction that the majority are to have must come in the elementary school. Some lines of knowledge may increase as the individual grows older, but there is little, if any, parallelism between age and arithmetic ability for adults, so dependence on such presupposed relationship will fail.

Even if we are willing to grant that an arithmetic ability equal to that of an eighth-grade graduate is sufficient for most social purposes, there are 45 percent who have not reached this point in school; and the 55 percent who have may expect to lose in later life at least 8.6 percent of their schooltime ability.

But we have seen that the eighth-grade ability—considerably higher than that of adults with the same school education—does not equal the arithmetic ability of the lowest occupational group listed—that of "dentist." Indeed the lowest school group whose mean score equals that of the dentists is the second grade of the high school, a grade reached by only 18.6 percent of the boys. The mean score for "clerks" is reached by only 1.5 percent of the army men.

The present standard in arithmetic instruction as measured by this test—at least in the schools tested—seems to be too low; but without further investigation we cannot well decide what it should be.

An ultimate standard in arithmetic must be set high enough to allow for a loss of from 8.6 percent to 10.4 percent for the upper three grades of the elementary school.

SCHOOL FINANCE IN IOWA

E. E. Lindsay
State University of Iowa

During the past year a study has been made of the condition of school finance in Iowa. It is the purpose of this article to show two things; first, how the amount of money going to school purposes in Iowa cities and towns compares with the amounts which these same cities and towns are spending on other items, such as light, water, streets, etc.; second, how the school money is spent by the school authorities after it comes into their hands.

Expenditures for Schools and for Other Municipal Purposes

Data on 459 Iowa cities and towns are presented in this summarized article. This represents a very large majority of all the towns in the state. The last state census (1915) gave Iowa 103 towns having more than 1000 population. Data are here reported on 148 such towns. The discrepancy in the figures is, of course, accounted for by the lapse of time (1915 census). Of the 685 towns under 1000 population 486, or 71.0 percent, are here reported. This material was gathered in two ways, first by sending to each county auditor a card for every town within his county, with careful instruction as to his filling it out and returning it[1]; second, by personal visits to those counties whose auditors did not respond, even after the request had been repeated.

For the purpose of rendering the comparison more usable and more dependable the cities and towns were divided into six groups according to population, as shown in the tables below. The method used in making these comparisons was not that of comparing the actual sums of money spent but the millages as levied for the various purposes. The millage used in all cases was that finally assessed upon the property, hence comparison is fair and

[1] This card called for many other things which are not dealt with in this article.

accurate. On the one side were thrown all millages going to school purposes. These in Iowa fall almost entirely into two categories so far as the tax is concerned, namely, the general fund and the schoolhouse fund. On the other side were put all millages as assessed for municipal purposes other than schools. These included water, light, streets, bonds, police, library, fire, sewers, sanitary, and in some cases many other items. The totals in both cases were then added and the school millage divided by the resulting total. This gave a percent which represented accurately the proportion of local taxes that were available for the schools of the city or town. To make this method clear the following illustration is cited. Sioux City, Iowa, had a school levy of 67 mills. All other municipal levies totaled 26.9 mills. The total local levy was then 93.9 mills. Of this total, the school levy was therefore 71.3 percent. This represents the proportion of local taxes for school purposes in Sioux City.

The median percents for all the towns, grouped according to population, are shown in Table I. The consolidated districts are dealt with separately, as is obviously necessary. Column 5 of the table, which is labeled "coefficient of variability" shows a very significant thing in regard to each of the groups. In dealing with a large number of cities, as these figures do, it is very convenient to have one figure which will express in itself as many facts as possible. This coefficient of variability expresses what could otherwise be shown only by giving the percents for all the towns in each groups or at best by giving the quartiles and ranges. The quartiles in the groups that here show the largest coefficient, (towns of less than 500 population) are 75.7 percent and 54.5 percent. The group showing the lowest coefficient, (cities having populations between five and ten thousand) has quartiles of 68.7 percent and 59.6 percent. The coefficient is a measure of the amount of deviation from the percent given for the group. The lower the coefficient the more nearly do all the towns conform to the median percent here given.

Table I shows that all Iowa towns and cities of whatever sizes, whether located in a consolidated district or not, *spend more*

TABLE I.—RELATION OF EXPENDITURES FOR SCHOOLS TO EXPENDITURES FOR OTHER MUNICIPAL PURPOSES IN IOWA TOWNS AND CITIES

Population groups	Number of districts	Percent of local tax given to schools	Rank	Coefficient of variability	Rank
1	*2*	*3*	*4*	*5*	*6*
Towns					
Less than 500	200	65.4	2	.162	6
500–999	111	65.7	1	.144	5
1,000–1,999	70	64.6	3	.124	4
2,000–4,999	50	60.6	5	.101	3
5,000–9,999	15	62.7	4	.073	1
10,000 and over	13	59.4	6	.087	2
Consolidated Districts					
Less than 500	115	67.3	1	.131	2
500 and over	60	59.0	2	.113	1

on their schools than on all the other objects of municipal expenditures combined. In the cities and towns outside of consolidated districts this table provides an adequate basis for the statement that *the larger the city the smaller the percent of total municipal expenditure which goes to schools.* This is not necessarily a criticism of the larger city. In fact other data in the possession of the author but not here presented show that the highest per pupil school expense in Iowa cities outside the consolidated districts was in that group of cities that spent the lowest percent of their total municipal levy for schools, namely the group of cities having populations of over 10,000. This group which apportioned but 59.4 percent of the total municipal levy for schools, spent $107 per pupil; while the groups under 1000 in population apportioned about 65 percent of their levy to schools, but by so doing they obtained but $86.60 per pupil. The descending percent of total municipal expense going to schools as the cities grow larger may be as well accounted for by the increase in other municipal expense as by the decrease in amount of school support. In fact, the former is in most cases the explanation.

In the consolidated schools, the percent of local tax available to school purposes is expected to be high as compared with town

districts. In towns of less than 500 located in consolidated districts there is about a two percent difference made by the fact of consolidation. That is, the towns without consolidation spend but two percent less of their local tax for schools than do those with consolidation. In towns of over 500, however, consolidation cuts down the share about five percent. These figures might serve as a financial argument for consolidation in the larger villages and towns. In general the percents given in Table I could be very profitably used by individual towns as a basis for comparison. The percent given for each population group is the standard practice in Iowa towns of the indicated size (in so far as the median represents the standard); and any one may compare the local school levy with this standard.

The coefficients of variability show that the practice in the larger towns is far more uniform than that in the smaller. It is a striking fact that just as the former statement, "the larger the town the lower the percent," holds true, so here the data justify a statement exactly the reverse, namely, "the smaller the towns the greater the lack of uniformity in practice." The correlation with size (groups alone being considered) is in both cases practically unity.

How the School Money is Spent by the School Authorities

The following tables give school expenditures data on 132 city, town, and consolidated-school districts. These data while not nearly so extensive as those presented in the foregoing section of this article, do cover a large enough portion of the possible cases to render the findings fairly reliable.

In this study, the 132 school budgets involved were grouped according to magnitude, three groupings being used as indicated in the sub-titles of Table II. The items of expense used conform closely to the system adopted by the N. E. A. and by the Federal Bureau of Education. The percents are the medians for the

groups to which they refer.[2] The coefficients of variability show the same facts for Table II as for Table I, namely, the amounts of deviation from the median percents. The expense items are arranged in descending order of magnitude and the coefficients of variability are ranked for each of comparison.

TABLE II (A.)—PROPORTION OF EXPENDITURES FOR VARIOUS PURPOSES. BUDGETS OF $60,000 AND OVER

Classification	Percent	Rank	Coefficient of Variability	Rank
Teaching	64.8	1	0.092	7
Operation	16.6	2	0.241	6
Debt Service	7.8	3	0.330	4
Administration	4.8	4	0.265	5
Maintenance	3.2	5	0.655	2
Fixed Charges	1.1	6	0.590	3
Auxiliary Agencies	0.4	7	2.060	1

(B.)—BUDGETS OF $20,000 TO $59,990

Classification	Percent	Rank	Coefficient of Variability	Rank
Teaching	63.7	1	0.084	7
Operation	14.3	2	0.266	5
Administration	9.4	3	0.135	6
Debt Service	7.4	4	0.561	4
Maintenance	1.4	5	0.895	3
Fixed Charges	0.8	6	1.094	1
Auxiliary Agencies	0.6	7	1.000	2

(C.)—BUDGETS OF LESS THAN $20,000

Classification	Percent	Rank	Coefficient of Variability	Rank
Teaching	56.5	1	.121	7
Operation	15.8	2	.253	5
Administration	15.1	3	.154	6
Debt Service	4.95	4	1.162	3
Maintenance	1.65	5	.681	4
Fixed Charges	0.65	6	1.960	1
Auxiliary Agencies	0.45	7	1.553	2

[2] These medians do not total to 100, nor could this be expected in the case of medians. The fact, however, that the totals are in all cases less than 100 (ranging from 95.1 to 98.7) indicates that items of small expenditure have been omitted. This does not affect the reliability of the figures appearing in the table.—*Editor.*

(D.)—BUDGETS OF CONSOLIDATED SCHOOLS

Classification	Percent	Rank	Coefficient of Variability	Rank
Teaching	39.5	1	.146	8
Transportation	21.6	2	.257	6
Debt Service	11.11	3	.509	4
Operation	10.95	4	.338	5
Administration	9.85	5	.213	7
Maintenance	1.30	6	1.077	2
Auxiliary Agencies	0.65	7	.692	3
Fixed Charges	.50	8	1.300	1

There are certain things common to all of these groups of budgets. *First,* teaching requires the largest percent of money and is the least variable. That is to say, in these Iowa systems teaching is the largest item of expense and the one about which there is the most agreement as to the proportion of school money devoted to it. *Second,* debt service in all cases ranks as the third or fourth item of expense. *Third,* next to teaching, administration shows the greatest agreement as to the proportion of expense. *Fourth,* maintenance, auxiliary agencies, and fixed charges are the three items consistently requiring the smallest proportion of the budget, and they are also the three showing the widest variation.

The condition regarding debt service should be commented upon. That Iowa schools are running upon borrowed money to such an extent that the annual expenditure for such service ranks in many instances next to that for operation of the plant is a situation hardly financially sound. The pay-as-you-go policy has been neglected in past years by Iowa towns. Moreover, depreciation in plant has not been recognized, and little thought has been given to the needs of the future. The school plant has been used to the extent of its possibility and then bonds have been voted to erect another. A reasonable degree of business sense, in the financial management of these schools in years past, would have dropped this item to the rank it should rightly take in any enterprise. The existence of laws that recognize the fundamental factors of plant depreciation in the continued existence of any corporation would have had or would now have the same effect

on public school finances as the investment sense of the American public and corporation law have upon the management of enterprises that depend for their existence upon sound financing. The data which this table presents are concrete evidence of the day-unto-day haphazardness of public school financing of the past. No business enterprise could exist with such a management and there are many who are beginning to believe that even the vast resources of the American state are reaching the limit of taxation.

In general it may be said that, among Iowa town- and city-school systems, items of expense rank as follows: first, teaching; second, operation; third, or fourth, administration or debt service; fifth, maintenance or auxiliary agencies; sixth, maintenance or fixed charges; and seventh, auxiliary agencies or fixed charges. The exact order of these items and the percents here given should be of value to any superintendent or school board planning a new budget.

In the budgets of consolidated districts, transportation and debt service occupy respectively the second and third positions. This means that the consolidated schools of Iowa are paying nearly as much to get the children to school as to educate them after they are there. The means is costing nearly as much as the end. This does not mean that the consolidated schools have poorer teachers or are paying less money for them. Other data in possession of the author show the contrary to be true. Iowa consolidated schools in towns of less than 500 population are spending $143 per pupil as against $86 in the same size towns without consolidation. Not only is this true, but the group of cities in Iowa spending the largest per pupil amount is spending 25 percent less than these same consolidated schools. Incidentally they are doing it at a rate of taxation nearly double that of the consolidated school. The per pupil expenditure in consolidated districts in excess of the per pupil expenditure of towns of similar size is more than enough to pay for this high transportation cost and still employ the same or a better grade of teachers. Nevertheless, the transportation item does seem rather excessive. One can not teach children until they are in school; but it may

be that the bus drivers' salaries approximate or even exceed those of the teachers—a condition which would not be justified by the importance of the service which the drivers render.

The position of debt service in the budgets of the consolidated schools means that these schools are paying more for interest and bonds than they are for the operation of the plant which these bonds have provided for. It means that only two items of expense exceed these payments, namely teachers salaries and transportation. This is perhaps explained by the fact that the consolidated movement is new in Iowa, and that most of the districts therefore, have new buildings to pay for. Aside from the items of transportation and debt service, the budget items of the consolidated schools correspond in rank order to those of the non-consolidated schools having budgets of approximately the same size.

In conclusion, it is the opinion of the author that the figures contained in this article, both for the proportion of municipal expense available for public schools and for the distribution of school expense among the various items, will be rather widely applicable outside of Iowa. There is little reason to suppose that the place of the school in the Iowa town is different from its place in the towns of other states, particularly the midwestern and northern states. And there are many reasons for assuming the internal school practices of Iowa to be very similar to those of her sister states. The figures given are in terms of percents; and the number of cases on which they are based is, with the possible exception of larger cities, sufficient to permit reliable conclusions.

A COMPARISON OF THE BRIGHTNESS OF COUNTRY AND CITY HIGH-SCHOOL CHILDREN

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PURPOSE AND METHOD

The results here reported came to light in an investigation whose general purpose was to inquire into the relationship existing between general intelligence, as determined by group mental tests, and the choice of and success in high-school subjects. Comparisons were especially desired between groups choosing vocational subjects and those choosing non-vocational subjects. Pupils having the privilege of electing Latin, Spanish, French, vocational agriculture, home economics, and trades and industries were selected for the tests. A vocational and a non-vocational group were chosen from each school. Tests were made in practically every type of school in Texas, both white and colored, offering electives in the Smith-Hughes vocational subjects and in some non-vocational subject. Some of the non-vocational subjects were offered as electives only in the larger city schools. The fact that the Latin students, for example, were not equally distributed among the different types of schools may account for the high score attained by this group.

Several of the groups were taken from a city system. To offset the city system, however, groups were also chosen from four rural schools located in the open country some distance from the railroad. Groups were likewise included from two small town schools which had, respectively, seven and nine teachers, and were located in towns of about 1,000 inhabitants. The six remaining schools were located in towns somewhat larger, having from twelve to twenty teachers. All of the latter had some kind of college affiliation.

In each case the hearty cooperation of the principal and teachers was first obtained. If they were at all skeptical of the value of mental tests, the school was passed by. The Otis Group

Test, Form A, was used. The test conditions were made as nearly uniform as possible, and the tests were administered strictly according to the procedure prescribed by the author. In making comparison, the Otis* index of brightness was used. Medians and other values were computed by the methods suggested by Rugg.*

Results

It is evident from a study of Table I that the students in the various types of schools differ in intelligence level. For the 164 pupils in city high schools the median index of brightness (I. B.) is 100.5; that is, 0.5 above the norm given by the author. The same table shows the distribution of I. B.'s for the 290 pupils in the six affiliated and classified town schools. It will be seen that a median I. B. of 98 places this group 2.5 points below the median for the city group. The median I. B. for the 59 pupils in the unaffiliated small town schools is 84.4, or 13.6 below that of the affiliated town schools and 16.13 below that of the city schools. Finally, the median of 77 for the rural schools is 23.5 points below that of the city schools.

The gradual decrease in the median I. B., as shown above, indicates that urban pupils are more adept in answering the type of questions found in the Otis tests than are those living under more rural conditions. The results might possibly be invalidated to some extent by the small number of pupils shown. However, it is the opinion of the writer, based upon a long association with the pupils in these types of schools, that the medians would be changed very little if the numbers had been doubled or tripled. If the distributions for the third and fourth groups are combined as one unaffiliated rural-school group, a better distribution curve will result, without changing materially the conclusion reached. The difference can not be due to sex, since the number of boys and girls in each group is approximately equal. Nor can the results be due to the presence of foreign children. The city system and three of the affiliated town schools had, in fact, more than their share of the foreign element. One of the small town

* See references at end of article.

TABLE I.—DISTRIBUTIONS OF OTIS INDICES OF BRIGHTNESS IN DIFFERENT TYPES OF HIGH SCHOOLS

Type of School	Otis Indices of Brightness																	
	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-109	110-119	120-129	130-139	140-149	150-159	160-169	170-179	Median
City high schools (164 cases)		1	1	1	4	13	21	21	19	20	23	15	11	11	2		1	100.5
Affiliated town schools (290 cases)			1	10	17	23	31	31	40	41	37	30	13	7	7	2		98.0
Unaffiliated small town schools (59 cases)		1	1	4	4	6	10	8	8	3	9	3	1		1			84.4
Rural schools (68 cases)	3		4	5	7	8	10	9	11	1	2	6	2			c		77.0

unaffiliated schools and two of the rural schools also had several immigrant pupils. It is clear, therefore, that the results could not have been materially affected from this source.

Conclusions

These tests represent as nearly average groups of students in each type of school as it was possible to obtain. This being the case, the conclusion seems to be justified that the country child is lower in general mentality, as measured by the group mental test, than the city child. In a recent study Colvin* concludes that no group mental test is an absolute measure of general intelligence. He does find, however, that results from the use of the Otis test are closely correlated with a child's ability to succeed in the average high-school subject. Proctor* and others have reached the same conclusion in similar investigations. The sociologist would perhaps argue that differences in social environment and training account for the fact that the country child is not as well prepared for attaining high marks in this kind of test as his city neighbor; that the test is not a true measure of native ability. It should not be forgotten, however, that for years there has been a steady migration of the country's best to the city. Lincolns come from the rural districts, but they never go back. All of the available evidence points to the conclusion that the mental traits, whatever they may be, which are measured by the Otis group tests, exist to a less degree in the average rural child than in the average child of the city.

Colvin* further points out in his study of the Otis test that the median scores derived in his investigation are much higher than the norms given by the author. It is evident from the above discussion that the type of school in which the tests were given might easily influence the results.

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A PRACTICAL COURSE IN HOUSEHOLD CHEMISTRY

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A course in the practical application of chemistry to household problems has been instituted at the Pennsylvania State College during the present school year. The course was planned by the writer with the collaboration of Miss Edith P. Chace, Director of the Department of Home Economics, in this school. For a number of years it had been observed by Miss Chace that the students who went out from this and from other colleges as teachers of home economics in high schools were not as thoroughly familiar as seemed desirable with the actual application of chemistry to the problems of their own field. There was no doubt but that the chemistry which the girls had received was very thorough as far as the subject itself goes. The students in the department of home economics at this school have always been given the same training in inorganic chemistry, in organic chemistry, and in qualitative analysis, as that given to the men who have specialized in the different pure and applied sciences.

That there was something lacking, however, in the training which the girls had received in this subject or that there was something which did not get across to them seemed undoubtedly to be the case. This conclusion was reached as a result of the numerous inquiries from the girls themselves concerning very simple matters which had proved puzzling to them after they had gone into the field of activities. These questions came to Miss Chace through the mails, through personal interviews with the girls, and through round-table discussions, conducted at different institutions and at other gatherings of high-school teachers. All such questions were preserved with the view of arriving at some sort of solution of the difficulty. Quite independently the writer had been led, through criticisms of a similar nature coming from many different quarters, to collect practical questions which chemistry could be made to solve.

From all the different sources, between eight hundred and a thousand such questions were at hand when work on this course was inaugurated. The following group of 25 questions taken from Miss Chace's notes gives an idea of the raw material from which the course developed:

1. What chemical reaction goes on when a person irons clothes?
2. How does soap help in washing dishes?
3. How may all-wool underwear be washed without shrinking?
4. Exactly why should a varnished surface be washed without soap?
5. Why will washing powder soften water?
6. What is meant by a calorie?
7. Why does the application of a mustard plaster relieve pain?
8. How does starch stiffen a man's collar?
9. Why do we find soot on our cooking utensils?
10. Why do one's eyes smart in a room filled with smoke from burning meat?
11. What makes an egg spoil?
12. Why does silverware tarnish?
13. What is mother of vinegar?
14. Why does iron rust appear on improperly rinsed clothes?
15. What is bluing?
16. Why won't dyes for silk and wool color cotton and linen materials?
17. How can one explain the process of oxidation so that the drafts in a stove can be understood?
18. What chemical reaction takes place when home-made soap is made from beef tallow and wood ashes?
19. Why do some commercial stove polishes cause explosions?
20. What kinds of foods give a chemical reaction with aluminum kitchen utensils?
21. To what is the cleaning property of such washing powders as "Gold Dust" and "Pearline" due?
22. What is the composition of face powders and rouges and what is their effect on the skin?
23. Why does bleaching powder sometimes make holes in the garments on which it is used?
24. What is the composition of liquid soaps found in public lavatories?
25. Why does the gas oven sometimes explode when lighted?

The course in household chemistry is planned with a two-fold aim: (1) to supply the mechanical subject matter needed to give the student of home economics a better understanding of such practical questions as arise in other subjects included in the home economics curriculum; and (2) to equip the student for dealing with the chemical problems arising in the activities of an institutional manager, a teacher of household science, or a housewife. Only subject matter, which satisfied needs coming under one or the other of these two aims, was included in the course.

In order to secure a list of those needs which could be classified under the first aim, teachers of housewifery, textiles, and of other subjects of the home economics curriculum, were interviewed and asked this question: "In this course in household chemistry, what specific topics do you wish discussed in order to prepare the students for your own subject?" With reference to the second aim, the questions collected in the manner described above were analyzed and then organized. At first these questions seemed to form a hopeless hodge-podge of non-related topics; but when they were properly classified, it was found that they could be grouped around a few common problems.

The course in household chemistry was placed in the second semester of the sophomore year, because the students by this time had been given one semester's work in each of the subjects, inorganic chemistry, organic chemistry, and qualitative analysis. The problem of the relation of chemistry to the study of foods was planned as a separate course to follow the more general course, and for this reason is not now discussed.

A brief description of the course follows. Under each main problem is given an outline of the sub-problems considered, followed by a brief analysis of the function of this sub-problem to the problem as a whole, together with an explanation of its method of presentation.

PROBLEM I.—THE APPLICATION OF CHEMISTRY TO PROBLEMS OF WATER SUPPLY AND WASTE DISPOSAL

1. *A study of the mineral content of typical natural waters.*—In this connection the students analyze samples of water from the town water

supply, first quantitatively in order to determine its total mineral content, and second qualitatively in order to find out the nature of the mineral matter contained in the water. By consulting published data on the mineral content of typical natural waters, the student makes comparisons between the water analyzed and other typical waters.

2. *A study of hard water.*—

(a) Lecture demonstrations are given to show the type of mineral matter which causes water to possess the property of hardness. The types of mineral matter causing hardness which is capable of being relieved by boiling and that type which can only be relieved by the addition of certain reagents are demonstrated. The effect of hardness of water on such domestic operations as laundry work and dyeing, as well as the effect on the amount of soap used for toilet purposes is brought out by lecture and demonstrations.

(b) Laboratory determinations of a quantitative nature are performed by each student in order to determine (1) the soap-lathering ability of soft compared with different types of hard waters, (2) the soap-lathering ability of one certain hard water after it has been softened with washing soda, with borax, and with typical commercial washing powders. From the latter study the comparative cost of softening water with soap and with the different agents used is calculated by each student.

(c) Lecture demonstrations are given to show how hardness of water affects certain industrial operations, the Permutite process for softening water on a commercial scale being demonstrated, and an explanation being given of the application of the above laboratory methods of water-softening on a commercial scale. The possibility of softening water on a large scale for uses in hotels, boarding schools, etc., is also discussed in a lecture.

3. *The purification of water for drinking purposes.*—

(a) By lecture-demonstration methods the common types of impurities present in typical waters used for drinking purposes are presented together with a means of removing these impurities, (1) if the problem is one which has to be solved by each individual household, and (2) if the problem is to be undertaken by the community as a whole.

(b) Students prepare a filter which can be used for domestic purposes. Students also perform laboratory experiments which show the processes of filtration, coagulation by the addition of chemicals, addition of disinfectants, etc.

(c) Students are asked to assume that they are serving on some sort of a committee which is investigating conditions having to do with water purification. Some students are asked to assume that they live in a large city which derives its water supply from a certain river; other students are placed in different types of localities, the water supply coming from various sources. Each student is then permitted to study

the problem and to present a report to the entire class, the report covering the findings of her particular committee with regard to the best type of water purification to be undertaken under the particular conditions assumed.

4. *The study of waste disposal.*—

(a) A lecture on the subject of garbage disposal is given for the purpose of explaining correct and incorrect methods of garbage disposal, (1) if the problem is left to the devices of each household, (2) if the problem is in the hands of municipal authorities. Ordinances from the municipal statutes of various cities are read and discussed. The two methods practiced in different communities (namely, disposal of all waste by completely destroying everything collected, and recovery of such material as can be put to use) is a topic selected for a brief debate conducted by members of the class, the instructor judging as to which side presents the better argument.

(b) A lecture is given on sewage disposal, the chemistry of nitrification and putrification being presented with a view to determining which of the methods in common use in different typical homes are conducive to the proper chemical reaction.

(c) The students are taken on a tour of inspection through the city sewage disposal plant.

(d) With the help obtained from the above trip and from lecture discussions, each student draws plans for a sewage disposal system for an individual home, different types of homes being assigned to the different students so that a correct solution of the problem for a family of means as well as for a family of very limited means may be discussed.

PROBLEM II.—THE CHEMISTRY OF CLEANSING AND POLISHING AGENTS

1. *Chemistry in soap making and in the process of cleaning.*—

(a) A lecture is given on the history of the soap industry, the composition of soap, and the means of manufacturing a typical laundry and a typical toilet soap.

(b) Students are presented with about twenty trade formulas for soap making, these formulas having been modified and reduced to laboratory proportions. They write the formulas for the fats used in each case, and the equations for the saponification reaction which takes place in ten of the examples. Each student then selects one of the formulas, prepares the soap in the laboratory, and assumes that she is going to place the soap on the market. Acting under this assumption, she gives the soap a trade name, describes the purpose for which it can be used, and writes an advertisement for its sale. When this exercise is completed, the student should know the composition of soaps for various purposes.

(c) The various theories concerning the action of soap on grease and dirt are presented to the student in lectures.

2. *Detergents in general.*—

(a) Farmers' Bulletin Number 861, issued by the United States Department of Agriculture, is used as the basis for this study. The reason for selecting this bulletin is the fact that it is used in this school as the basis for the study of detergents in the housewifery class, and also the fact that this bulletin is in common use among housewives. Students are given samples of different kinds and colors of cloth with the kinds of stains commonly met with in actual practice. They determine by experiment the best reagent to apply for the removal of the stain in each case. This work is supplemented by lecture work on the composition of the stains and on the chemcial action involved in their removal. Students in reporting on their laboratory work, present mounted samples showing the effects of the different treatments, together with an account of whether the reaction in each case was one of chemical change, or whether it was due to the solvent action of the agent applied, etc.

(b) Furniture, stove, metal, and shoe polishes are studied in laboratory supplemented by lecture explanations. Students are presented with typical formulas used for making polishes of each of these kinds. Each student selects one formula in each case, prepares a small sample of the product in the laboratory, applies the polish to the type of article for which it is intended, and then writes a brief account of the purpose of each constituent in the polish.

Problem III.—The Chemistry of Fuels

1. *Heat of combustion.*—A lecture is given on the subject of "Heat of Chemical Reaction" for the purpose of explaining the meaning of "Heat of Combustion" with reference to fuels.

2. *A study of coal.*—A laboratory demonstration is given by the instructor to demonstrate the use of the Bomb Calorimeter and of the Parr Calorimeter; this demonstration being followed by a discussion of the subject, "Buying Coal on Specification." This is followed by a consideration of various plans for applying the commercial methods of testing coal to the testing of coal for the benefit of the private consumer.

3. *A study of gaseous fuels.*—

(a) Natural gas. The bulletins issued by the Bureau of Mines are used as a basis for the study of natural gas. The following topics are discussed in a demonstrated lecture: composition of natural gas, reasons for its high calorific value, means of securing its complete combustion in a gas stove as a means of conservation.

(b) Coal gas. Each student prepares coal gas in the laboratory. She is given a problem on the comparative cost of various fuels, based on their cost and calorific values. The advantages and disadvantages of the different fuels in respects other than calorific value are discussed. The object of this mathematical problem with the supplementary

discussion is to show the factors which should be taken into consideration in selecting a fuel for a certain purpose.

(c) Acetylene. Each student prepares Acetylene in the laboratory. She draws a diagram of a possible Acetylene system for a country home.

4. *"Canned heat."*—In response to numerous inquiries concerning the composition of various trade products coming under this head, each student is given a copy of a practical formula for the preparation of "Solid Alcohol" and is permitted to prepare a sample of the product in the laboratory.

PROBLEM IV.—THE APPLICATION OF CHEMISTRY TO MEANS OF PREVENTING AND EXTINGUISHING FIRES

1. *The causes of fires.*—Students are assigned reading material supplemented by a lecture on causes of fires, prevention of fires, and spontaneous combustion, and by a discussion of the regulations of fire insurance companies.

2. *The prevention of fires.*—Students perform laboratory experiments on (a) the preparation of carbon dioxide and its properties, (b) the properties of carbon tetrachloride, and (c) the properties of fusible alloys, such as Wood's Metal. The purpose of these exercises is to form a basis for the demonstration on fire extinguishing devices which follows.

3. *Fire extinguishers.*—Demonstrations are given by the instructor to show the structure of the two most common types of domestic fire extinguishers; namely, those of the Pyrene type, and those of the carbon dioxide type. This is followed by demonstration to show the value of these two types of extinguishers in putting out bonfires. The structure and principle of "sprinkler systems" and systems which have automatic fire alarm devices are presented by lecture and demonstration.

PROBLEM V.—THE APPLICATION OF CHEMISTRY TO A STUDY OF PAINTS, VARNISHES, AND LACQUERS

1. A lecture is given to show the composition of a typical mixed paint, the function of each part of the paint being given. A brief description of the Old Dutch Process for making white lead is given in this connection.

2. Each student performs a laboratory study of the composition and properties of linseed oil and of metallic soaps with the purpose of determining their value in paints.

3. In the laboratory each student prepares ten pigments, methods of precipitation being used. Each student writes the equation for the reactions in each case, mixes the pigment according to instructions given, and applies the paint to squares of wood or to some wooden

object which the student wishes to paint. The purpose of this study is to show the composition of various colored pigments.

4. A classroom discussion is held on the subject of the kinds of paint to use, and the kinds not to use in various places. The warnings given in the bulletin issued by the United States Department of Agriculture on the subject of what paints to use on various farm buildings forms the basis for the discussion, the chemical reactions involved in each case being presented.

5. A lecture is given on the composition of ordinary varnishes, of water-proof varnishes, of lacquers, and of luminous paints. This is followed by a laboratory exercise in which each student prepares one varnish and one lacquer from formulas supplied by the instructor, applying the product prepared in each case to a suitable surface, and writing a brief description of the function of each ingredient.

Problem VI.—The Application of Chemistry to the Silicate Industries

1. A lecture is given on the scope of the silicate industries and their importance to the housewife. This lecture covers the composition of clays in general, the reactions which take place in nature with the formation of clays, the variation of the composition of clays used for making various articles such as dishes, bricks, potteryware, terra-cotta, and porcelainware.

2. A laboratory exercise is given each student on the preparation and use of a cement for mending broken dishes. This is given at the request of the instructor in housewifery.

3. A lecture is given on the composition and chemistry of Portland Cement. This is accompanied by a demonstration on the methods in use in commercial practice for testing the qualities of a cement block. The purpose of this demonstration is to show the qualities desired when cement is purchased according to specification.

4. A lecture is given on glass manufacture including a discussion of the composition of glass, the reactions taking place in its manufacture, the composition of different types of glass, etc.

5. Students are given simple laboratory exercises in glass-blowing, the purpose being to exemplify more complicated commercial methods.

6. Each student prepares a series of colored glass beads, the purpose being to show the composition of various types of colored glass.

Problem VII.—The Application of Chemistry to a Study of the Composition and Identification of Textile Fibers

1. A lecture is given on the composition of typical fibers which are used for making fabrics.

2. Laboratory exercises are performed by each student on the microscopic identification of such fibers as wool, silk, cotton, shoddy,

wild silk, artificial silk, and linen. In this connection stress is laid on the simpler tests which might easily be used in the home. This last study covers simple differentiation tests for the fibers which are commonly substituted for one another in commerce, such as wool-cotton, silk-cotton, silk-wild silk, silk-artificial silk, linen-cotton.

3. A lecture is given covering the subjects of mercerization, dressing and weighting, water-proofing of textile fabrics, and fire-proofing of textile fabrics.

4. Each student performs a quantitative determination on a wool-cotton or a silk-cotton mixture in order to determine the percentage of weighting and the percentage of cotton present. By exchanging ideas as to the results obtained on various typical samples, each student obtains some idea of the composition of typical textile fabrics on the market.

Problem VIII.—The Application of Chemistry to Dyeing and Bleaching Processes

1. *Natural dyes.*—A lecture is given on the history of the dye industry until 1856, the time of the discovery of the first synthetic dye. This covers the use of Tyrian purple, alizarin, indigo, tumeric, cochineal, and logwood, as well as some of the old mineral dyes, such as iron buff, of our Colonial ancestors.

2. *Synthetic dyes.*—

(a) Students prepare aniline blue in the laboratory, the purpose being to give them an idea of the general methods of preparing synthetic dyes.

(b) A lecture is given on the coal-tar dye industry, the preparation of aniline dye by the students being used as a basis for the discussion as to the general methods employed commercially for building up in the laboratory a large number of dyes.

3. *Mineral dyes.*—Students prepare ten typical mineral dyes, and write all chemical reactions involved.

4. *Classification of dyes according to method of application.*—Students perform laboratory experiments on dyeing actual fabrics with typical direct dyes. These are usually applicable to woolens and silks, but not to cotton materials. Students apply dyes which require a mordant, the chemistry of the action being presented in each case. These typical laboratory experiments which each student performs are made the basis for a class-room discussion of the chemistry of various common dyes used in home dyeing processes.

5. *Bleaching.*—A laboratory exercise on bleaching of raw textile fibers, as well as the bleaching of textile fabrics, which have been dyed with organic dyes, and of those which have been dyed with mineral dyes, is given. The first portion of the exercise is given to satisfy a request

from the textile department that we show commercial methods of bleaching raw materials in their process of manufacture. The second portion is given for the two-fold purpose of showing the student, first, that certain bleaching agents applied for the purpose of removing stains can not be applied to materials dyed with certain types of dyes, and second, that faded dresses are sometimes capable of being bleached white.

Problem IX.—The Application of Chemistry to a Study of Toilet Preparations

This problem is the result of requests from students concerning the composition of various toilet preparations. Its incorporation in this course was heartily indorsed by the members of the home economics department, especially since the American woman is spending each year more money on preparations of this kind.

1. A lecture is given on the composition of typical toilet preparations such as face powders, face creams, freckle creams, manicure preparations, depilatory powders, tooth powders and pastes, foot powders, perfumes, and hair preparations.

2. In the laboratory each student is permitted to make five toilet preparations in which she is particularly interested, a group of formulas for each of the preparations, outlined in the lecture, being on file in the laboratory. The student reports on each product, outlining the use of each constituent, and showing the exact cost at current market prices of the material as prepared.

3. A lecture is given on the injurious materials sometimes used in toilet preparations. Students are given references to read on this subject; and they are then given samples of commercial products to test for the presence of injurious ingredients.

Problem X.—The Application of Chemistry to a Study of Simple Remedies

1. Two lectures are given on the composition, the properties, and the effect on the human organism of common medicines such as quinine, aspirin, acetanilide, castor oil, herb tablets, sal hepatica, common blood medicines, and tonics.

The composition of various patent medicines, with a warning against the use of some of them, is brought out.

2. Students make simple tests for quinine, iron compounds, etc., for the purpose of applying these tests to a few common patent medicines in order to determine their composition.

3. A lecture is given on the subject of "Poisons and Their Antidotes." The entire purpose of this is to make clear the chemistry involved in the action of the antidotes which should be administered for poisons.

LOST IN CONCRETE INSTANCES—MANY LEARNERS

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The average teacher assumes, when he gives one or two concrete instances involving a certain principle, that the learner is pretty sure to get the principle involved. In demonstrating modes of procedure in the administration of intelligence tests this assumption is placed on trial.

Because about 25 percent of the men of the National Army did not have adequate schooling to enable them to take the Alpha test for literates they were given a non-verbal test (Beta), each part of which was demonstrated practically without language. Before each part of the test was tried by the men, problems were presented on a large chart illustrating the principles involved in that part of the test. These problems were solved in pantomime by an assistant after aid had been given in pantomime by the examiner (or demonstrator). Following such demonstration the soldiers were started to work at the problems of the part of the test which had thus been demonstrated. For example, the second exercise of Beta requires that the soldier indicate in written figures below each group of drawn cubes, the number of cubes represented by the drawing of that group. These groups grow successively harder from the first to the last on the page. The demonstrator first presents the actual cubes which he counts in pantomime and then associates by gesture with the same kind of a group of blocks drawn on a chart. Below this group of three blocks he signals, by pantomime, to his assistant to write the figure 3, meaning "three blocks in the picture." Several more difficult groups of cubical drawings are thus counted in pantomime, after which the soldiers are signaled to go ahead and count the blocks in like manner in all groups of cube-drawings on their test page.

To what degree did the principles thus involved get across? Soon after the signing of the Armistice, and before the Psycho-

logical Board at Camp A. A. Humphries was dissolved, the writer with the aid of several enlisted men of that Board studied this problem in respect to the Beta papers of 1466 men. It was found that 453 men, or 31 percent, wrote the figure 3 under the picture group of two cubes, the first problem, evidently because in the demonstration the first picture group represented three cubes. In other words, about a third of the men failed wholly to grasp the principle involved. They merely repeated a concrete instance by imitation.

Is this failure to get the principle involved from the several concrete instances an index of a low grade in intelligence rating? Is suggestibility as manifested by the 31 percent an indication of their low intelligence?

The Beta letter ratings from the highest to the lowest grades are A, B, C+, C, C—, D, D—. Now, of these 453 men who failed on the first simple problem of counting two blocks, 76 percent got D or D— in total Beta. Only 3 percent got above C. On the other hand, of the remaining 1013 men who did not write the figure 3 (but who wrote 2 as it should be) under the drawing group of two cubes, only 53 percent got D or D— in total Beta and 17 percent got above C.

Similarly, the principles of Test III in Beta were so demonstrated in the first step that the experimenter directed his assistant, by pantomime, to place O's in the empty squares on the chart that followed a series of squares already filled with O's. In the first test problem of the soldier's blank was a similar row, but with a series of X's instead of O's. Instead of supplying these omitted X's many of the men copied from memory the O's as they had seen them in the chart demonstration. Four hundred and three men, or 27 percent of the 1466 men, thus supplied zeros instead of X's. Of these, 84 percent received D or D— and only 2 percent got above C— in total Beta rating. Of the remaining 1063 men, only 51 percent got D or D— and 21 percent got above C.

From this one may conclude that those who failed to get the principle involved in this simple demonstration but who gave

evidence of a kind of naïve memory (perseveration) were more often relatively inferior men in Beta than those who did resist the tendency to imitate the demonstrator and who did grasp the principle.

This surprisingly strong tendency blindly to reproduce definite concrete data instead of grasping the principle involved suggests a danger in the present emphasis on the "concrete in education." While the concrete is the indispensable avenue to abstractions, there is no assurance that the learner will ever arrive at a general idea or principle just because he is on this avenue. The average lecturer, preacher, textbook writer, and teacher assumes that with appropriate concrete data presented in a certain sequence the desired abstraction will inevitably follow. There is a strong tendency for teachers and textbook writers who are eager to simplify the lesson to turn definitions into concrete instances or to substitute the latter for the former. Such teachers present facts in that fashion. Thus habitually they may answer questions by the pupils and accept answers from pupils entirely in terms of one or two similar concrete instances. Let it be remembered that, by the mere law of association and because of human laziness, when several instances are given, there is a strong likelihood that the instances will be similar and not, in the mind of the learner, necessarily representative of the possible varieties of examples of the principle involved.

The instances *per se* are not in error. They are often an indispensable asset; but the danger lies in stopping with them. There must be a surety that the learner actually arrives at the principle involved and that the concrete instances do not become the mere object of his interest, the actual end in itself, instead of a symbolozing means to that end.

To his chagrin the writer has frequently discovered, after numerous concrete instances had been elicited from various members of his class in introductory psychology illustrative of a principle which the writer felt certain the class all had in mind, that few or none of the class really had seen the principle involved. They had merely been gathering instances by means of "that-reminds-me" process.

If the wide activity in visual education is to realize its purpose, this problem must be taken into account. Otherwise, not only will the concrete data serve as a temporary distraction from the desired general ideas and principles involved, but also the learner by such continuous appeals will develop habits and attitudes of responses to specific situations independent of the principles they symbolize, which will inevitably carry over or transfer *ad libitum*. Grave dangers certainly there are, then, that the learner will be lost in concrete instances.

The effectual teacher is one who constantly appeals through the concrete to the principle involved, *but who never fails to lead the learner always to arrive in safety at that principle.*

A METHOD OF COMMENSURATING MENTAL MEASUREMENTS

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I.—THE KENTAL PRINCIPLE

A problem that is always present with those concerned with the measuring of mental and social phenomena is that of reducing to common terms quantities stated in terms of incommensurate units. To use a simple illustration, how may a subject's performance in a test of attention and his performance in a test of perception be reduced to terms that make precise comparison possible? Clearly, the crossing of the letter 'A' in the one case bears no manifest numerical relation to the addition of integers in the other. A new and serviceable method of effecting such commensuration will doubtless be of some interest to investigators.

The device ordinarily employed in biological studies to effect commensuration is the Galton percentile, which furnishes a method of comparing the performances of subjects in a series of tests. The method herewith suggested will, I believe, be found superior in point of accuracy and adaptability to the purposes of educational measurement. The unit of the system has been named the *kental*.[1] A comparative demonstration of the two methods will serve to bring out their theoretical differences.

Tables I and II record the performances of two groups of subjects, U, a group from cities, and V, a group from villages, on two tests—Table I for the 'A' test of attention,[2] and Table II for the simultaneous adding test of perception. In these tables the third group, C, combines the groups U and V. Column S records the original scores of the subjects; column P gives their percentile; and column K their kental equivalents. The percentile, of course, represents the rank of a subject's performance in

[1] Adapted from the Latin *centum*.

[2] See Whipple: Mental and Physical Tests, Vol. 1, p. 305.

the series, expressed in percentage terms, the position of the highest score furnishing the base of computation. Thus, in a group of fifty, the subject who ranked first would be given a percentile rating of 100 because he was one hundred percent removed from the position of the lowest rank; the subject ranking tenth would be given a percentile rating of 80 because he was eighty percent removed from the position of lowest rank. In strict accuracy, these values should read 99.5 and 79.5, for in a group of one hundred the chances are even that the performance would be ranked 99 or 100, 79 or 80.

The kental equivalent of a measurement is obtained in an altogether different manner. The essential steps in the process are:

1. Determine the *range* of values represented in a given given series of measurements. This is done by subtracting the lowest score from the highest.

2. Determine the *elevation* of each measurement in the series by subtracting from it the lowest score.

3. Express these elevations as percents of the range.

Here is a simple illustration of this procedure. Let the highest score be 150, the lowest, 75, and the given score be 120. The range will be 150 — 75, or 75. The elevation of 120 is 120 — 75, or 45. Reduced to a percent of the range 75, 45 becomes 60, which is the kental transversion of the measurement 120.

It may appear that the base of the kental unit might better be the span of the first and third quartiles or the first and ninth deciles rather than the extreme margins[3] of the total range. This would, of course, give greater invariability to the standard range inasmuch as the extreme marginal variables would be eliminated. A range determined for a given test from a standard group in one laboratory might more nearly be supposed to be equal to the ranges for other tests determined from groups in other laboratories. The practical effect of this would be to introduce the 100+ transversion for all scores above the third quartile or the

[3] "Margin" is here used as in economics to designate the items of extreme variation.

TABLE I.—PERCENTILE AND KENTAL EQUIVALENTS OF MENTAL MEASUREMENTS. SIMULTANEOUS ADDING TEST OF PERCEPTION

Key: U = urban group of subjects; V = village group; C = urban and village groups combined; S = original measurements or scores of subjects; P = their percentile equivalents; K = their Kental equivalents; M = median; Q_3 = upper quartile; Q_1 = lower quartile.

Subject	C.			U.			V.		
	S.	P.	K.	S.	P.	K.	S.	P.	K.
1	419	100.0	100.0	419	100.0	100.0			
2	384	97.4	83.9				384	97.4	83.9
3	378	94.9	81.1	378	94.9	81.1			
4	372	92.3	78.4	372	92.3	78.4			
5	370	89.7	77.5				370	89.7	77.5
6	368	87.2	76.6	368	87.2	76.6			
7	365	84.6	75.2				365	84.6	75.2
8	362	82.0	73.9	362	82.0	73.9			
9	361	79.5	73.4	361	79.5	73.4			
10	353	76.9	69.8				353	76.9	69.8
11	348	74.4	67.5				348	74.4	67.5
12	341	71.8	64.3	341	71.8	64.3			
13	338	69.2	62.9				338	69.2	62.9
14	333	66.7	60.6	333	66.7	60.6			
15	332	64.1	60.2	332	64.1	60.2			
16	331	61.5	59.7	331	61.5	59.7			
17	324	59.0	56.5				324	59.0	56.5
18	323	56.4	56.1	323	56.4	56.1			
19	320	53.9	54.8				320	53.9	54.8
20	318	51.3	53.9	318	51.3	53.9			
21	310	48.8	50.2	310	48.8	50.2			
22	306	46.2	48.3	306	46.2	48.3			
23	300	43.6	45.6	300	43.6	45.6			
24	295	39.7	43.4				295	39.7	43.4
25	295	39.7	43.4				295	39.7	43.4
26	294	35.9	42.9				294	35.9	42.9
27	290	33.3	41.0				290	33.3	41.0
28	280	30.8	36.5	280	30.8	36.5			
29	277	26.9	35.1	277	26.9	35.1			
30	277	26.9	35.1				277	26.9	35.1
31	276	23.1	34.7				276	23.1	34.7
32	271	20.6	32.4				271	20.6	32.4
33	258	16.7	26.5	258	16.7	26.5			
34	258	16.7	26.5				258	16.7	26.5
35	255	12.8	25.1				255	12.8	25.1
36	226	10.2	11.9				226	10.2	11.9
37	212	7.7	5.5	212	7.7	5.5			
38	208	5.1	3.6				208	5.1	3.6
39	200	2.6	0.0	200	2.6	0.0			
Q_3	353	76.9	69.8	362	81.4	73.8	348	74.4	67.5
M	318	51.3	53.9	327	58.9	57.9	295	39.7	43.4
Q_1	277	26.9	35.1	285	34.0	38.8	271	20.6	32.4

TABLE II.—PERCENTILE AND KENTAL EQUIVALENTS OF MENTAL MEASUREMENTS. A-TEST OF ATTENTION

Subject	C.			U.			V.		
	S.	P.	K.	S.	P.	K.	S.	P.	K.
1	106	100.0	100.0	106	100.0	100.0			
2	105	97.2	97.3				105	97.2	97.3
3	103	94.5	95.9	103	94.5	95.9			
4	101	91.8	93.2	101	91.8	93.2			
5	99	87.8	90.4	99	87.8	90.4			
6	99	87.8	90.4	99	87.8	90.4			
7	98	83.8	89.0	98	83.8	89.0			
8	95	81.1	84.9				95	81.1	84.9
9	94	78.4	83.6				94	78.4	83.6
10	93	75.7	82.2	93	75.7	82.2			
11	92	71.6	80.8	92	71.6	80.8			
12	92	71.6	80.8	92	71.6	80.8			
13	91	67.6	79.5	91	67.6	79.5			
14	89	64.9	76.8				89	64.9	76.8
15	87	62.2	74.0				87	62.2	74.0
16	82	59.4	67.1				82	59.4	67.1
17	81	56.8	65.8				81	56.8	65.8
18	80	52.7	64.4				80	52.7	64.4
19	80	52.7	64.4				80	52.7	64.4
20	78	48.6	61.6	78	48.6	61.6			
21	77	44.6	60.3	77	44.6	60.3			
22	77	44.6	60.3				77	44.6	60.3
23	76	40.5	58.9	76	40.5	58.9			
24	74	37.8	56.2				74	37.8	56.2
25	73	35.1	54.8	73	35.1	54.8			
26	72	32.4	53.4				72	32.4	53.4
27	70	28.4	50.7				70	28.4	50.7
28	70	28.4	50.7				70	28.4	50.7
29	66	24.3	45.2	66	24.3	45.2			
30	63	21.6	41.1				63	21.6	41.1
31	62	18.9	39.7	62	18.9	39.7			
32	60	14.9	37.0	60	14.9	37.0			
33	60	14.9	37.0				60	14.9	37.0
34	57	10.8	31.9				57	10.8	31.9
35	50	8.1	23.3	50	8.1	23.3			
36	40	5.4	9.6				40	5.4	9.6
37	33	2.7	0.0				33	2.7	0.0
Q_3	93.5	79.7	92.9	99.0	87.8	90.4	87.0	62.2	74.0
M	80.0	52.7	64.4	91.5	69.6	80.1	77.0	44.6	60.3
Q_1	69	26.3	47.9	71.2	32.4	52.4	63.0	21.6	41.1

ninth decile, as the case might be, and the o— transversion for all scores below the first quartile or the first decile. Thus, in Table I, if the quartiles instead of the margins determined the range, it would be 76 instead of 219. The kental equivalent of the score 419 would be 187, and the equivalent of the score 200 would be —101. In the practical application of the kental, these minus scores might be mistakenly interpreted by inexperienced workers to signify negative quality.

The underlying assumption of the kental method is that *the range of ability obtaining within a sufficiently large group of subjects conforming to given standards of age, sex, physical and mental condition, race, social status, and educational advantage is constant enough to serve as a standard unit for the measurement of mental abilities.* In other words, this is to say that mental abilities within social groups vary only within definite limits. This is but a special case of the general biological principle of the limitation of variation within the species. If the trait of intelligence can vary only within definite limits, then our measurements of the trait can vary by no wider interval.

It may be argued that while the kental method may serve to overcome difficulties in measurement due solely to the incommensurateness of the units of measurement, it still fails to reduce measurements of dissimilar processes to common terms. The assumed equivalence in range of all mental processes, it may be said, is fallacious by analogy with variations of other physical processes. Individual variations in height, for example, are by no means equal to variations in weight, and variations in cephalic index are by no means the same as variations in girth of chest. Therefore, the normal range of memory capacity, for example, may not be held to be equal to range in judgment capacity.

There are two replies that may be made to this line of argument. In the first place, it must be noted that inequality in range of mental processes is just as much an assumption as equality. Having units of measurement that enable us to measure physical traits in common terms, we can say definitely that differences

in variability exist. Lacking such units for the measurement of mental traits, we cannot speak with such finality in this field. Secondly, is it not fair to hold that a difference of 1 mm. in head circumference is more significant than a difference of 1 mm. in chest girth? The kental method aims to measure variations by percents. On this basis, a one percent variation in head circumference might be held to be equivalent to a one percent variation in girth of chest, and a one percent variation in memory

TABLE III.—QUARTILE COEFFICIENTS OF DISPERSION (Q.D.) AND SKEWNESS (Q.J.) FOR GROUP C OF TABLES I AND II

	C-I			C-II.		
	S.	P.	K.	S.	P.	K.
Q. D.	.12	.48	.33	.15	.50	.32
Q. J.	−.07	.02	−.08	.10	.01	.27

capacity might be held equivalent to a one percent variation in judgment capacity. From a functional point of view, mental processes are at least as much alike in kind as such traits as cranial and thoracic circumference and therefore as comparable.

A point that is to be specially noted in the comparison of the kental with the percentile method of commensuration is that the kental may be given a fixed unitary value by standardizing the minimum and maximum scores marking the limits of the range for all tests in general use.[4] The percentile can not be standardized in this way because its value is based on rank or position in series merely, without reference to the absolute value of the measurement for which it is the equivalent. Thus, in Table I any constant might be added to or subtracted from the values under S without altering the values under P. Indeed, any increase or decrease of the values under S that did not alter their position in the series, no matter how much their quantitative relations might be disturbed, would have no effect on the values

[4] Scores near the margins of the series may be used to designate the limits of the range if the margins themselves vary widely from the general tendency of the dispersion.

under P. On the other hand, any change in the quantity of the values under S would be accurately registered under K.

In statistical terminology we may say that measurements of dispersion and skewness for a kental transversion of a series of values vary with measurements of dispersion and skewness for the original series. This means that we may obtain directly from a kental series coefficients of dispersion and skewness which will be as valid for comparative purposes as are similar coefficients derived from the original series. Table III gives the quartile coefficients of dispersion and skewness for the original scores and their percentile and kental transversions. It will be noticed that the coefficients derived from the percentile series do not measure either dispersion or skewness. This is due to the fact that percentiles indicate *rank* in series merely. Hence the intervals between the items of any percentile series are always equal and the distribution graph of such a series is always a straight line. Theoretically, the coefficient of dispersion of such a distribution is 0.5, and the coefficient of skewness 0. The slight variations from these theoretical norms noticeable under P in Table III are due to the small error incidental to the manipulation of figures.

All this clearly indicates the relatively greater accuracy of the kental as against the percentile method. It follows then that percentiles are less adaptable to the purposes of social measurement than are kentals. Obviously, 34*p* deduced from one series of measurements may stand for a performance that is markedly different from a 34*p* performance deduced from a different series of measurements. On the other hand, given the standardization suggested, 34*k* will always stand for the same degree of ability in subjects tested.

The kental is defined as *the unitary value attaching to the one-hundredth subdivision of the standard normal range of ability for any standard mental test.* Where large numbers of measurements are to be transverted into kentals, the scores may be arranged in the form of a frequency table with one hundred classes, the class interval being one-hundredth of the range of

scores. The number of a given class may then be assigned as the kental equivalent of all scores entered in that class. Thus, if the range were 250, the class interval would be 2.5. Suppose the limits of the 82nd class to be 90 and 92.5. Then all scores above 90 and not exceeding 92.5 would be given a rating of 82*k*.

The exactness of the results to be obtained by the method herein described will be dependent on the instrumental precision of the tests employed in making the original measurements. If measurements obtained from the application of tests S and T are to be commensurated, and S represents a very refined measurement of a given process, while T is only a rough approximation to such a degree of accuracy, then clearly the chances are that the range of ability exhibited by the results from S will be greater or less than the range of ability exhibited by the T measurements; and the 100*k* and the 0*k* measurements for the two tests represent degrees of ability that vary with the precision of the tests used. Granted equal instrumental precision for all tests employed, *nk* always stands for equivalence of ability.

Strict accuracy in the commensuration of measurements would further require that the processes measured be of the same value as factors in intelligence. A 100*k* performance for a test of attention would not necessarily be taken to signify adaptive capacity identical with that of a 100*k* performance for a difficult test of judgment; but merely that in each case the performance denoted maximal ability. However, the evaluation of mental processes as adaptive and the rating of tests with respect to instrumental precision are problems of experimentation and not of commensuration. Hence, while they enter into the consideration of the usefulness of the kental unit, they do not at all affect its theoretical validity.

II.—The Coefficient of Learning

Let us now consider an application of the kental principle to the problem of educational measurement. In Table IV-A have been recorded the results of a study of seventh-grade pupils in a large city where educational research has been well organized.

All pupils were divided into six classes on the basis of their intelligence scores. The medians for these six classes have been recorded in column M.I. The upper and lower limits of the range have been parenthesized. Columns A., R.C., and L. record the median scores attained by the subjects in the six intelligence classes in tests of ability in arithmetic, reading comprehension, and language. The obvious value of such a table is to bring into prominence the relation between intellectual capacity and attainment in learning. If this relation can be reduced to the form of a numerical ratio, we shall have a real index of learning efficiency.

From Table IV-A it is evident that the practical results of instruction do not correlate one hundred percent with the potentialities of the group as indicated by measurements of intelligence. Some classes are obviously doing better than others for the intellectual capital they possess. Striking differences in degree of

TABLE IV.—MEDIAN SCORES OF INTELLIGENCE CLASSES FOR SEVENTH-GRADE PUPILS

Key: M.I. = intelligence scores; A = arithmetic scores; R.C. = reading comprehension scores; L = language scores. Scores in parentheses are individual scores marking the upper and lower limits of the range.

A. Original Scores.				B. Kental Transversions			
M. I.	A.	R. C.	L.	M. I.	A.	R. C.	L.
(90)	(8.0)	(37.0)	(26.7)	(100)	(100)	(100)	(100)
86	7.0	32.3	21.1	.91	.80	.79	.67
75	6.6	26.8	18.8	.68	.72	.56	.54
69	6.1	23.8	16.7	.55	.62	.43	.41
65	5.1	23.6	15.8	.47	.42	.42	.36
56	5.1	21.5	14.0	.28	.42	.33	.26
48	4.6	18.0	13.8	.11	.32	.14	.25
(42.5)	(3.0)	(13.6)	(9.5)	(0)	(0)	(0)	(0)

correspondence between intelligence and attainment are brought out by comparing the ratio of the intervals between medians for the intelligence series with the ratio of corresponding intervals between medians for the attainment series. Thus the ratio of the interval between the first and second intelligence classes to the

interval between the second and third intelligence classes is observed to be 11:6, while the corresponding ratio for the arithmetic series is 4:5. But while it is clear that there is relatively closer agreement between attainment and intelligence in some classes than in others, the exact degree of correspondence is obviously difficult to state. Table IV-B facilities comparison by giving kental equivalents for the original scores. However, before discussing the use that is made of these attainment equivalents, it is necessary to justify the validity of the kental method in effecting such transversions.

If there were a correlation of one hundred percent between intelligence and educational attainment, we should be justified in holding the range of ability measured by the marginal intelligence scores to be identical with the range of ability measured by the marginal attainment scores. The ratio of a subject's attainment score to his intelligence score would then give us the learning efficiency of the subject, which, in the case assumed, would be one hundred percent. But, owing to the vicissitudes of class instruction and other factors conditioning learning, we do not get a correlation of one hundred percent between intelligence and attainment, as the results of Table IV have shown us. Statistical studies generally, however, have shown a rather high correlation between native intelligence and ability to learn. This suggests a rather close approximation between the ranges of intelligence and attainment, and gives us warrant for assuming, as a working hypothesis, their equivalence as units for the measurement of ability.

The main objection that is likely to be raised against the kental transversion of attainment measurements is the lack of an adequate logical justification for the assumed equivalence of ranges for attainment tests. While the constancy of the factors conditioning general intelligence, on the one hand, it may be said, may warrant us in assuming equivalence of range for a series of such tests, the variability of the factors conditioning learning, on the other hand, obliges us to concede the unequivalence of range in the case of attainment tests. For example, if the instructional

methods under which two groups of subjects have been schooled show a tendency for the one to favor the superior student and the other the inferior, the range of the results for any given test, as arithmetic, will vary in the two cases. Where the method favors the superior student, the range will be greater than where it favors the inferior. The difference in range is here discoverable. But if we compare results for two different tests, as arithmetic and language where the same possibility of variation in instructional method exists, in the absence of specific standards for the determination of the incidence of methods, how shall we be able to say which range is the greater and which the lesser? The problem is, then, to find a method of standardizing attainment ranges so that it will be possible to set these ranges in equation with one another and with standard intelligence ranges.

Suppose that, out of thousands of seventh-grade pupils, tested for intelligence and attainment in arithmetic, twenty-five should fall in the one hundredth kental intelligence class. The raw scores of these twenty-five subjects for the arithmetic test would vary within certain limits. This is the result of the tendency of individuals to vary more widely with respect to special than with respect to general capacity. The median attainment score of the twenty-five subjects may be taken as typical of the arithmetic ability of seventh-grade pupils of a 100*k* intelligence. We may, then, fairly hold that the attainment median scored by the maximal or one hundredth kental intelligence class and the attainment median scored by the minimal or first kental intelligence class mark the upper and lower limits respectively of the attainment range which may be taken as typical of the given range of intelligence.

From the theoretical point of view, under experimentally ideal conditions, the attainment scores of a group of subjects of a given class or level of intelligence, will vary within the limits $y_1 \ldots y_n$. Following the law of probability, these items will be distributed in accord with the curve of normal frequency, which identifies the position of the measures of central tendency, the mean, mode, and median. If we let y_m stand for the central

tendency, then we can say that where any set of factors, such as superior instructional method, operates to produce a score exceeding the central tendency by the amount t, as $y_m + t$, a set of factors as, in this case, inferior instructional method, will operate equally by the amount t in the opposite direction to produce a score of $y_m - t$. It follows, then, that the intelligence medians, of n classes of subjects will correlate unity with the respective attainment medians, $y_{m1}, y_{m2}, \ldots y_{m_n}$ of these same intelligence classes. Hence, the range of ability measured by the attainment medians of the marginal intelligence classes is theoretically identical with the range of ability measured by the intelligence medians of these same classes. In this way, I believe, a satisfactory basis for the equation of the kental attainment range with the kental intelligence range is provided.

The method of marginal medians for computing the attainment range for Table IV was not followed for the reason that the necessary data concerning all subjects were not available. The range employed was obtained from the highest and lowest scores. While this method is not as strictly accurate as the one just discussed, it is sufficiently so to illustrate the principles with which this paper is concerned.

It may seem at first glance that the method of highest and lowest scores does not show the relation between intelligence and attainment for the subjects of highest and lowest rank respectively. If, for example, a subject receiving a kental intelligence score of 87, should receive a kental attainment score of 89, the ratio of the second to the first would be more favorable than it would for a subject whose score was 100 in both cases. Even if the second subject should advance his raw attainment score by a considerable amount while the raw score of subject one should remain unchanged, the ratio of his attainment to his intelligence score would still be 100:100. In other words, his raw attainment score would advance while his kental attainment score would remain the same. But while the raw score of the first subject remained absolutely the same, his kental attainment score would decline. This would be due to the fact that the absolute ad-

vance of the raw attainment score of the second subject (scores of other subjects remaining constant) would increase the range and so decrease the value of the constant scores when they were expressed as percents of the increased range. Similarly, the effect of decreasing the absolute score of the subject of lowest rank would be to increase the range and so increase the value of the constant scores when expressed as kentals.

Thus it will be seen that the method of highest and lowest scores does serve to develop and render comparable differences in attainment and intelligence when both kinds of measurement are transverted into kentals. It will be found to tell a fairly truthful story so long as the highest and lowest scores do not vary extremely from the positions which the general tendency of dispersion within the group would assign them.

The foregoing discussion will doubtless suggest to the reader the possibility of expressing the numerical relation between attainment and intelligence as a ratio. We can not, however, use the simple ratio of the kental attainment score to the kental intelligence score as an expression of this relationship; for, owing to the difference in the value of items in the lower and upper parts of the range, such a ratio would be inaccurate. A difference of ten points in the upper part of the range would give an index quite different from that resulting from a difference of ten points in the lower part of the range. For example, if the subjects should receive an intelligence score of 100*k* and an attainment score of 90*k*, the ratio would be 0.9; but if his intelligence score should be 20*k* and his attainment 10*k*, the ratio would be only 0.5. Let us examine a way of improving on this crude ratio.

If we assume a perfect correlation between mental and educational ability, then the ratio between the attainment transversion of a given subject and his intelligence transversion would be an accurate index of his learning efficiency. If now we find *the difference between a subject's kental attainment score and his kental intelligence score*, noting the direction of difference by a plus or minus sign, we shall have a measure of the subject's devia-

tion from a perfect correlation. A deviation of +10, then, would mean that a subject's kental attainment score varied positively from his kental intelligence score by an amount equal to ten percent of the range. If now we let 100 stand for perfect correlation, and add to or subtract from this base, according to the sign, *the computed deviations from a perfect correlation*, we shall have a serviceable ratio of learning to intelligence. This ratio I have called the *coefficient of learning*. It signifies the efficiency to which a given subject or group of subjects have attained in the use to which they have put their intellectual capital in the process of learning.

TABLE V.—THE RELATION BETWEEN ATTAINMENT AND INTELLIGENCE SCORES

A. Attainment Deviations				B. Coefficients of Learning			
M.I.	A.-I.	R. C.-I.	L.-I.	A.	R. C.	L.	AV.
86	−11	−12	−24	89	88	76	84.3
75	+4	−12	−14	104	88	86	92.6
69	+7	−12	−11	107	88	89	94.6
65	−5	−5	−11	95	95	89	93.0
56	+14	+5	-2	114	105	98	105.6
48	+21	+3	+14	121	103	114	112.6

Since the kental range is always one hundred, this method of computing a coefficient of learning permits a record of all possible theoretical cases. As proof, consider the extreme possibilities. If the intelligence score is 0*k* and the attainment score 100*k*, the deviation is +100 and the coefficient of learning is 200. If, on the other hand, the intelligence score is 100*k* and the attainment score 0*k*, the deviation is —100 and the coefficient of learning is 0. Within these extremes lie all possible theoretical variations in learning efficiency.

In Table V-A are recorded the deviations of the attainment medians given in Table IV-B from the intelligence medians given in Table IV-B. In Table V-B the coefficients of learning have

been computed by the method just described. A study of Tables V-B and IV-A may serve as a test of the relative effectiveness of crude scores and coefficients of learning as a means of comparing attainment in learning with general intelligence.

The general conclusion to be drawn from Table V-B is that the resources of the pupils of highest intelligence have been taxed less severely by the learning process than have the resources of the pupils of least intelligence. The coefficient of learning appears to give an excellent check on the classification of pupils according to ability to learn. The desideratum certainly is that each pupil be given opportunity to advance educationally as rapidly as he may. It is bootless to argue in favor of a rigid classification according to intelligence alone, for it matters not so far as the organization of instruction is concerned whether a pupil's inability to advance is due to lack of intelligence, lack of interest, lack of instructional efficiency, or what not, so long as the fact of his inability is apparent. The coefficient of learning, to be sure, does not enlighten us as to the nature of the factors operating to accelerate or retard the pupil beyond the place which his intelligence would indicate he should occupy. It does, however, enable us to experiment intelligently with such factors and to determine their relative causal efficiency.[5]

In the elaboration of the method of this paper, the writer has aimed to facilitate the comparison of incommensurable quantities. According as it serves this end, the kental principle and its application in the computation of the coefficient of learning must be judged.

[5] In the comparison of the coefficient of learning with the achievement quotient as developed by Buckingham and Monroe, I have found that the computation of the quotient from mental and achievement ages requires on the average from five to six times as long as the computation of the coefficient from kental intelligence and attainment scores. The operations involved in deriving the coefficient of learning are, indeed, so simple that they may be performed by the average teacher without the use of deviation tables. The only tables with which it would be necessary to supply the practitioner would be the tables for transverting raw scores into kentals. The preparation of such tables, as described on p. 145, is so much simpler than the preparation of the tables for obtaining achievement ages and achievement quotients that the fact may appeal to the experimenter concerned with the standardizing of tests. The factor of age does not enter into the calculation of the coefficient of learning. The relation it draws between attainment and intelligence is immediate.

Editorials

THE USE OF THE MEDIAN IN SUPERVISION

Supervisors are well acquainted with the use of the average (arithmetic mean or median) for the purpose of summarizing in a single figure the performance of each class under their supervision. This device, however, is not as widely used as it might be. In particular, it is not applied to the supervision of such subjects as English composition and handwriting where the securing of an average is thought to be difficult. We believe that, partly for this reason, the supervision of such subjects—particularly of English composition—is less effective than the supervision of any major line of work attempted in the school. The mere bulk of the writing done by a class of average size makes it impossible for the supervisor to examine all of it. Moreover, the better the teaching of composition, the more there will be of such writing; and when to the amount of written material of one class is added the amount for all the other classes under a given supervisor, the problem of reading the material becomes impossible.

The median, however, is an average which may be applied to written compositions in such a way as to permit real supervision without undue labor. The reader will recall that the median is the middle item of a series arranged in order of magnitude. In order to establish it, it is merely necessary to rank the items; and this may be done without even knowing their values in terms of a definite unit. Anything which will differentiate the items so that they may be arranged in order of size will serve to determine the median. Indeed, it is not even necessary that all, or nearly all, of the measures should be so arranged. It is sufficient that the items occupying central positions be given their proper order.

In the case of samples of English writing, it is entirely practicable to arrange the papers in the order of their merit without

measuring any of them. When this has been done, the middle composition is the median or average performance of the class and may stand as the type just as appropriately as a numerical average or median obtained from a spelling test or an arithmetic test. If the question is asked, "How well did the class do this week in its composition work?" one may point to the median paper and say, "This is how well the class did." If it is then desired to have this median paper rated by means of a composition scale, the typical performance may thus be given numerical form.

We have said that it is entirely practicable to arrange compositions in the order of their merit. Supervisors know how inevitably a teacher puts the best composition on top of the pile which the supervisor is to see. The next best composition is second, and so on. There is here, whether for aesthetic or impressionistic purposes, an evident ability to distinguish between compositions on the basis of merit. In fact, the whole idea on which the rating of composition work depends—a rating which in the form of percents, units of a scale, or otherwise, is always regarded as necessary—is that one can distinguish merit in English writing.

It is conceded that in any given group of compositions, there will be a number of papers between which it is difficult to distinguish. This is particularly true among the papers written by the children of average ability. It is precisely among these papers, however, that the median is likely to be found. We suggest here the use of a pairing method. Having identified a number of the best and poorest compositions, one may arrange the middle group by comparing each paper in the group with every other paper, giving in each of the one-to-one comparisons a preference mark to the paper which is superior. Within this group of medium papers order of merit will then be established by giving first place to the paper having the greatest number of preference marks, second place to the one having the next greatest number, and so on. If it should be found that even by the use of the pairing method the merit of some compositions can-

not be distinguished, and if the median composition is among these, it is clearly immaterial which of these compositions is taken as the median.

But by whatever means the compositions are arranged in the order of merit, the middle one may be taken as the type. Of course, if there is an even number of compositions, there is no middle one, and one of the two middle papers should be selected. As a practical procedure it would be well to agree to take the better of the two, and to do so consistently. As a matter of fact, the difference in merit between the better and the poorer of these two compositions would scarcely be appreciable.

The progress of a class over a period of time may be noted by comparing a series of these median or typical compositions. It will be found to be stimulating to mount the typical compositions of a class on a chart. If a set is obtained each week, one might then have for each class from fifteen to eighteen typical compositions during a semester. These, whether or not they are rated by a composition scale, will picture the amount of improvement in the class throughout the term.

This is a supervising device. It is not to be understood as a teaching device in the sense that it gets at individual differences. It is true that it will stimulate effort on the part of both teachers and pupils; but so will any good supervisory device. The value of the scheme lies in the fact that it enables the supervisor to keep track of the trend of teaching so far as that trend is manifested in the general merit of composition writing.

Moreover, it is a device applicable in surveys. The reason so little space in published surveys is given to English composition is because of the difficulty of measuring it. There is no disposition among surveyors to belittle it as unimportant. The few surveys which have attempted to measure the work of school systems in English writing have done so at the vast expenditure of energy necessary to rate all, or a very great number, of the composition papers. Yet the averages or medians of these ratings were the figures in which the surveys were primarily interested. We submit that it would be far less laborious, and

would probably make it possible for the surveying of composition work to be more frequently attempted, if the teacher of each class arranged the pupils' paper and identified the median paper. This could then be measured by means of a scale. The few samples which this method would require the surveyors to rate would enable them to have each sample rated by several judges. In other words, our suggestion would be that instead of measuring all the samples and obtaining the medians from the measures, it would be equally satisfactory and far less expensive to obtain the median first and then to do the measuring.

B. R. B.

INCREASING PRODUCTION

The president of a business concern is a hard customer for his research man to handle. His is not the paternal attitude which graces the personality of the university president as he fosters and protects research. He has a voracious appetite for results which show in economy of production. He may permit the research executive to study his own little hobbies or engage in the investigation of long term problems; but here and now at very short intervals he requires him to show concrete evidence of increasing economy in production. The president is interested in the development of standards by which to measure efficiency and in the defects of operation which the standards reveal. But he immediately wants to know how the defects are to be cured. His appetite for this diet is particularly keen and if he is placed upon short rations he becomes irritable and will, in a moment of undernourishment display temper and fire the cook. He has not been sold to the idea that research conducted merely for its own sake is worthy of support as a business proposition.

This situation has its defects and its advantages. It may lead the research man to turn out hasty work, but it also leads him to keep persistent pressure behind his investigation so that he is able to turn out good work rapidly. It is even possible that his work may be better than would be the case if it were done in more leisurely fashion. Then too, the wise research man by dividing his problems into two classes, long term and short term, has

enough of the former to satisfy himself and of the latter to satisfy the firm. But he knows that all his problems must center round the procedures for increasing production. Tests and standards are useful as indices of efficiency or its lack, but they are only one of the many tools which he must use in securing efficient operation of the business.

A public school system is a production organization. The board of directors are laymen, who have a superintendent of the plant to administer the technical end of the business. He has teachers as foremen who direct the pupils as workmen. The problem of production is present—the manufacture of experience and the acquisition of learning. The school production plant is subject to all the defects of any other production organization. The pupil-workmen are willing or unwilling, ignorant or intelligent, wasteful or economical of effort. The teacher-foremen are good disciplinarians or poor, they route the material economically or extravagantly, they train efficiently or inefficiently. The superintendent may be keen for efficiency, or he may be busy with the details of his office and not know what is going on in the workrooms. He has trouble in judging of the output because it is not put up in bales or measured in money.

At this point enters the efficiency man. He is employed, opens a research bureau, and is given *carte blanche* to do what he can to increase efficiency. The superintendent may have faith in the outcome or he may, as many business presidents do, follow the fashion because it is not good form for any progressive organization to be without its research department. But whatever the cause, the research department is installed.

The first task it undertakes is to establish standards. Educational tests are given in arithmetic, spelling, writing, and other school subjects; and the work of teachers and pupils is evaluated for praise or censure. Mental tests are administered and both the defective and the supernormal are detected. Creditable reports are published, filled with findings which show comparisons of class with class, school with school, and system with system.

At this point the parallel between educational production plants and industrial plants ceases. The business president, with

his eye fixed steadily upon profits, intimates to his research man that now is the time, after the standards have been made and applied, to make studies of methods of curing the defects. He insists upon time studies, and training in the more efficient methods which research reveals. No matter what the efficiency executive may prefer to do, he is compelled for the good of the business and for his own safety as well, to study production processes.

On the contrary, the superintendent of the school production plant has less concern about his output because it is relatively intangible. He does not have to show dividends to his board of directors because the coin of his realm is spiritual and not material and financial. So his efficiency men are not brought to task if they stay in the fields of standards and tests and neglect the improvement of service.

But this does not relieve them from responsibility. They realize that many pupil-years of time are lost annually because of inefficient methods. By their tests they detect the widest disparity between teacher and teacher and between pupil and pupil. They know that the teacher is handicapped because of the lack of material in the form of books, exercises, and illustrative material. If the school were held to be a business, they would be compelled not merely to detect these deficiencies but in addition to remove them by studying methods of teaching and learning, by collecting generous supplies of the best methods from expert teachers and making them available for all, and by showing teachers how to save the time of the pupils and the pupils how to save their own. The insistent demand of business is for economical production and the inescapable duty of the educational research department is for the maximum of learning in the minimum of time.

The sagacious school superintendent has borrowed a leaf from the book of the industrial president and judges the efficiency of his research division by the results it is obtaining in his production division, in the workrooms of the school.

W. W. C.

Reviews and Abstracts

CAMERON, EDWARD HERBERT. *Psychology and the school.* New York: The Century Company, 1921. xiv + 339 pp.

This book is an introductory text in educational psychology, intended for teachers and students who have had no previous training in the subject. It contains first an account of the general facts and principles of psychology, treating the usual topics, including the nervous system, native and acquired behavior, sensation, perception, memory, etc., down to voluntary action. The condensed treatment does not permit of many illustrations, but the applications which are made are predominantly to educational situations.

The remainder of the book is more directly educational. Four chapters deal with the problems of learning, transfer of training, individual differences, and mental development and four with the methods of learning exhibited in certain of the school subjects, namely, reading, spelling, writing, and arithmetic. The author has shown skill in selecting the most important phases of these subjects for emphasis and has succeeded in presenting the chief known facts about them clearly and simply.

The style is very lucid and direct, the treatment of the various topics is balanced, and the selection of phases of the subject to be emphasized is judicious. The organization of the subject matter is logical and consistent and exhibits none of the careless planning which is often met with in books on educational psychology. The author's opinions are grounded upon a broad and thorough training in the science, and his presentation of the subject is the outgrowth of ample and successful experience as a teacher. The book, therefore, is an exhibition of thoroughly good workmanship and may be highly commended to teachers as an introductory textbook.

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CRANE, A. G. *Education for the disabled in war and industry.* (Teachers College, Columbia University, Contributions to Education No. 110) New York: Teachers College, Columbia University, 1921. 83 pp.

The author of this monograph was at one time Director of Educational Service, Division of Physical Reconstruction, United States Army. He embodies in it data from his more exhaustive volume on physical reconstruction in *The Official Medical History of the War.*

The introductory pages show the value of the educational service to physical reconstruction in providing "happy, useful, curative occupations." Then follows an analysis of the main factors in the educational problem,—

number of patients, nature of disability, previous schooling, intelligence, previous vocation, preference for future work, available time and equipment.

The magnitude of the whole undertaking may be seen from the fact that instruction was given in 150 subjects to 100,000 men in 50 hospitals by 2500 instructors. The enrollment in educational classes increased during 1919 from 29 to 61 percent of the total hospital cases. The curative work was sometimes general (e.g., building up physical tone) and sometimes specific (e.g., typewriting for stiff fingers). A novel aspect of the latter was metro-therapy—the measurement of extent of motion in disabled members by ingenious attachments and the use of practice curves in prescribing treatment and to encourage the patient. While the work at its inception was mainly for curative purposes (occupational therapy) it became closely related to vocational readjustment (rehabilitation). While performing educational projects to help cure his disability, the patient was in many cases receiving training that would assist him in his subsequent vocation.

A chapter is devoted to methods of survey, guidance, and instruction. The soldier received a medical, surgical, and psychological examination and a thorough interview. When all the data were collated therapeutic and vocational plans were laid in conference with the patient himself. The instruction was based on "unit courses" organized about a task. For example in auto mechanics the course consisted of the repair and adjustment of a single engine. Each task was not only a complete unit in itself but was also part of a series of courses in the same general field. Thus, a patient who was in the hospital for only a short time could take at least one course, while a patient who was confined for a longer time could take a series. This method moreover made feasible the instruction of a man who by reason of disability could attend class only irregularly.

The author discusses finally the implications of the work of the educational service for schools and for the education of those disabled in industry. Statistics show that the problems of the disabled in industry are of considerable magnitude and fundamentally similar to those dealt with in the war. The methods of survey and guidance developed in the army might well be used with industrial patients. The fundamental principles of occupational therapy and rehabilitation are likewise applicable. The author stresses the short unit course organized about a task. While realizing that this is not the conventional procedure, he feels that "for motive and interest, for similarity to actual industrial conditions, in possibilities for acquiring a sustaining foothold in the industry in the shortest possible time, it presents manifold advantages." It makes it easier to induce men to undertake adequate courses of preparation. In the army the completion of one unit course left the student eager for the next. The text-book for such a series of courses comprises a collection of tasks with directions and references for each. The author goes on to suggest the possibilities of this method for education in general and particularly for the study of science and manual arts. "Electricity studied in connection with a telegraph project may be studied much more profitably than if the logical conventional method be followed."

The reviewer concedes the necessity of the unit course method of instruction in the war emergency and its probable advantage in some types of industrial rehabilitation but is not convinced of its value in general educational procedure. He wonders if it would produce, for example, outstanding men of science who would devote their lives to fundamental problems. He suspects that the average student who studied his electricity by telegraph projects would pursue as little fundamental theory as possible and would have little appreciation for scientific ideals. The danger of producing sterile technicians rather than productive scientists is not imaginary. And more fundamental still is the question whether we should train all the youth or should educate some of them.

The monograph gives in brief readable form the history of a very significant and novel branch of the army. It is clear and concise. The quantitative aspects are well presented in tables and charts. There are numerous illustrations and an appendix containing a number of case studies. In laying aside the book the reviewer has two distinct impressions: one, the magnitude of the tasks confronting those engaged in rehabilitation; the other, the interesting educational implications raised by the unit course method of instruction.

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O'BRIEN, JOHN ANTHONY. *Silent reading; with special reference to methods for developing speed.* New York: The Macmillan Company, 1921. xvii + 289 pp.

This book will be warmly welcomed by those who wish to encourage experimentation under normal school conditions, and particularly by those who are attempting to improve the various abilities involved in silent reading. This does not mean that the book is written merely for the professor, the superintendent, or the graduate student. Any professionally minded teacher who wishes to study seriously the problems in silent reading will find the book readable and very helpful. There is probably no single volume which so well presents in a few pages the essential knowledge of the technical elements entering into the process of rapid silent reading. It will doubtless find its place in the teacher's professional library alongside of Huey's *The Psychology and Pedagogy of Reading*, and along with the suggestive treatises which have recently appeared in special monographs and in the yearbooks of the National Society for the Study of Education. Doctor O'Brien's presentation is uniformly clear and plausible—so much so in fact, that it is perhaps worth while to urge certain cautions and reservations with regard to some of the conclusions implied or explicitly stated in the book.

1. In common with most writers who are insisting upon greater relative emphasis in silent reading, Doctor O'Brien leaves the impression that oral reading has little place, if any, in the school. Now oral reading can be justified, not as the best method of teaching silent reading (although Judd and Gray recommend this in the primary grades), but as a desirable social accomplishment and as an aid to literary appreciation, particularly in the case of poetry. The fact is that oral and silent reading constitute two objectives which must be attacked separately and by different technics. Of the two,

silent reading, because of its relation to study is, of course, vastly more important.

2. While it is undoubtedly true that the backbone of the course in silent reading would consist of "the synthetic mode of attack—training in the whole organized process of reading itself," this does not mean that elements may not or should not be isolated for special training. Indeed, this is exactly the method used by O'Brien although, of course, in the large reading setting. Moreover, others have obtained improvements as marked as those here reported—improvements which like these have resulted from exercises where the one variable consisted of practice in certain elements in isolation. This is particularly true in exercises in word, phrase, and sentence flashing. Although more likely to be abused, the principle of isolation of a given factor for special training is no less fundamental than that of "direct synthesis" as urged by O'Brien. These two methods of attacks go hand in hand, the synthetic method necessarily receiving the main emphasis, but being supplemented by exercises for the purpose of developing certain special abilities.

3. The author is perhaps over-sanguine as to the amount of improvement resulting from his exercises and as to the permanence of this improvement. There is reason to believe that the improvement from such exercises is rarely, if ever, so great as is indicated by increased scores on standard silent-reading tests. This is particularly true where the test in the practice exercises or the length of the exercises duplicate in kind the test and length of exercise in the standard test. In this case a part of the large improvement shown, both in daily exercises and tests, is likely due to the improvement in a special type of reading and in the ability to take a special type of test. On the other hand, there is clear evidence in the photographs of eye movement that marked improvement did occur. One naturally expects, too, that at least a part of this fundamental improvement will persist.

4. Too much emphasis cannot be placed upon the author's provision for assuring and testing comprehension. Indeed, many would go farther and provide that much of the reading be done for purposes other than to take a test, that is, with objectives in mind in the form of questions to be answered through reading. There is reason to believe that much better results in comprehension would have been obtained had the chief emphasis been placed upon having the children race to find quickly the answer to specific questions, rather than to read rapidly in order to be able to answer questions which are not in the pupil's mind while he is reading.

There are other questions raised by the discussions in the various chapters. For example, many may suggest that speed exercises are more advantageously conducted with factual, content material. In fact one of the chief values in this book is to be found in the clearness with which the chief issues are stated, and the consequent stimulation of a critical consideration of the data and conclusion which the author presents. It is natural that at this stage of the development of our knowledge of silent reading, there are, at certain points, differences of opinion. The book is proving a very valuable text for schools which are studying the problems involved in improvement of abilities in silent reading.

ERNEST HORN
State University of Iowa

O'BRIEN, JOHN ANTHONY. *Silent reading; with special reference to methods for developing speed.* New York: The Macmillan Company, 1921. xvii+289 pp.

This monograph presents the results of a very useful undertaking. It attempts to introduce and test in actual school practice an improvement in the methods of learning to read which laboratory experiments have long indicated to be worth trying. The author's specific problem, as indicated by the sub-title, deals with the methods for increasing the speed of silent reading. He has developed his methods as the result of a careful review and analysis of the now very extensive investigations of the reading process, many of which have, in recent years, been carried out with notable success at the University of Chicago. The author's own investigations were conducted under the auspices of the Bureau of Educational Research of the University of Illinois in forty classes of twenty different schools located in nine cities of Illinois. The training which extended throughout grades three to eight inclusive, was for thirty minutes a day for 36 days. Of this time 20 to 25 minutes daily was devoted to actual reading, sub-divided into five to seven short periods of intensive drill in which the attempt was made to increase the speed of reading without loss of comprehension or understanding of what was being read. In order to measure the progress three forms of the Courtis Silent Reading tests were administered, one at the beginning, one after the eighteenth day of practice and one after the thirty-sixth day of practice, thus involving altogether thirty-nine days of experimentation.

Three types of training in rapid silent reading are discussed in detail, and careful directions formulated for carrying them out. In Type I the advantages of rapid reading were presented to the pupils, and, after a short preparation for word recognition and thought getting, the following instructions were given:

"Read it as fast as you can. I want to see how much you can read in two (or three) minutes. But remember that I am going to ask you to tell me about what you have read, so do not skip anything. Try to read faster to-day than you did yesterday."

The method of training, thus, consisted essentially of alternate reading and of reproduction occupying not more than one quarter of the time allowed for the exercise. As incentives to increased speed each pupil kept a chart of his daily performance, and a complete chart of the daily class performance was conspicuously displayed in the classroom.

The Second Type of training attempted to decrease vocalization or inner articulation with idential instructions as in Type I for increasing speed. This instruction was therefore added. "Do not pronounce the words to yourself, as that will cause you to read more slowly than you otherwise would." As would be anticipated, it was found "that the effort to lessen inner articulation was far more successful when the individual not only consciously endeavored to inhibit such but also read more rapidly at the same time."

A Third Type of training was proposed, and discussed in detail, but not carried out for the lack of suitable apparatus; namely, to increase the span of word perception by short exposures of words, phrases, and sentences by means of a tachistoscope designed for class use.

Classes were divided into two groups, A, the experimental group, and B, the control group. The selection was very accurately made by pairing individuals who showed approximately the same speed on the preliminary Courtis test; one of each pair being put in the experimental and the other in the control group. Although the control pupils were taught by the same teachers in the same classroom, and themselves

showed considerable increase in speed of reading as a result of the attention given to the experimental group, the same difficulty so often faced in other investigations requiring control groups appears in this study. The instruction for the control group was that they were "to be taught in the usual way." They profited somewhat, however, by the special attention and general interest aroused by the experiment, although they lacked the specific incentives of individual and class charts for noting the rate of improvement, and of other exercises incident to the experiment.

The relative superiority of the experimental group over the control group at the end of the experiment, which is marked, must be discounted somewhat as a result of this last consideration. Not all the gain can be attributed to the methods in question. The average gain for the experimental pupils in the five grades was 110 words per minute, as compared with the control group's gain of 64 words per minute. Increasingly larger gains were made with each advance in school grade, that for the fourth grade being 80 words for the experimental group and 33 for the control group, as compared with 172 words for the eighth-grade experimental group, and 90 for the corresponding control group. The average gain of the eighth grade was larger than that of the seventh by 56 and 43 words for the two groups as compared with gains of 20 and 17 words by the two groups in the seventh grade over the averages of the sixth grade. The fifth-grade experimental group gained on the average but seven more words than the fourth, and the advance of the sixth grade over the fifth averaged also 7 words. The control groups in the third, fourth and fifth grades each showed about the same amounts of gain. These marked differences in the amount of improvement between the upper and lower grades must be kept in mind in any conclusions in regard to the factors which were most responsible for the gains noted.

These increases in speed were accompanied by slight improvements in the accuracy of comprehension. There was, at any rate, no loss in this latter respect.

Further objective evidence of improvement was secured in the case of ten pupils by photographic records of the eye movements and pauses before and after practice. These photographic records were made in the laboratory of the School of Education of the University of Chicago. The practice improvement was found to be accompanied by a reduction in the *number* of fixation pauses with little change in the *duration* of the pauses and by a noticeable reduction in the number of regressive movements of the eyes.

The monograph is well worth perusal for its excellent summary of the results of previous investigations bearing on the methods of the present study as well as for the results presented. The chief moral of this study is that less emphasis on oral reading and more attention during the formative period to the possibilities of silent reading may make for better readers.

WALTER F. DEARBORN

Harvard University

PYLE, W. H. *The psychology of learning.* Baltimore: Warwick and York, 1921. 305 pp.

"I have tried to state everything that is known about learning," announces Doctor Pyle in the preface of this new book. The delighted reader soon finds, however, that "to state everything that is known" is not equivalent to "knowing all that is to be known." Nevertheless, Doctor Pyle has brought together the best of the experimental literature on the psychology of learning, and while the sub-title, "An Advance

Text in Educational Psychology" leads the psychologist to expect critical discussions on the controversial points in educational procedure, the contents of this book are essentially practical in nature, addressed to the teacher or school supervisor rather than to the experts.

Each chapter is followed by a list of references; and, where possible, simple class experiments have been developed. The printing is good and the binding is serviceable. The lines of the graphs are too thin for the quality of the paper on which they are printed. The numbers showing the values of the coordinates are too small and weak and should be supplemented by the units of measurement. The descriptions of the experiments give the essential facts and Doctor Pyle's interpretation of their meaning.

In Chapter I, learning is defined as the process of forming habits and acquiring knowledge. A habit is regarded as an act that follows with more or less regularity, upon the presentation of a definite stimulus, to which it has become coupled through experience (p. 1). Knowledge is an idea following upon another idea or perception to which it has become coupled through experience (p. 2). Learning, on the physiological side, consists of building up and establishing preferential routes in the nervous system (p. 5). The only *method* in habit formation is the trial-and-error method when the movement involved has not already been mastered and coupled with the idea of the movement as its stimulus (p. 7). The nature of the learning curve is taken up in Chapter II. The limits of improvement, the different forms of curves, and some suggestions on curve plotting prepare the reader for the experiments reported in the chapters that follow.

The length and distribution of the practice periods, the degree of attention, the attitude of the learner, inheritance, incentives, feeling and emotional elements, the place of drill and its objectives, form the material for the next three chapters. The transition from the physiological aspects to the ideational aspects of learning occurs in Chapter VI. Association, thinking, reasoning, primary experience, the organization of experience, knowledge, meaning, how to study, are presented so as to show that ideational learning is of essentially the same nature as the formation of habits. Chapters VII and VIII cover a discussion of the conditions under which experiences are retained. As to the facts underlying the conceptions of general and specific ability, Doctor Pyle concludes that, "About all we can say is that some brains are better for the important purposes of life than are other brains. Our brains probably have general characteristics which are potent in all intellectual operations, hence, the general learning factor, and the central intellectual factor. But just as surely, brains have certain specific characteristics, effective in specific acts of behavior, characteristics that make one a better seer, or hearer, or taster, for example; characteristics that help or hinder in specific processes, and that must always be considered in connection with the general factor" (p. 172).

Measurements of learning capacity, tests, inter-correlations, relation between learning and general intelligence, are some of the topics considered in Chapter IX. The following chapter is devoted to individual and racial differences, and the causes of these differences are related to the conceptions underlying the classification of students. Deftness in avoiding controversy is shown in Chapter XI in which Doctor Pyle discusses transference and interference and about which he concludes that, "What we do today, determines and limits in some measure what we can do tomorrow. Knowledge which I acquire today may facilitate what I undertake to do tomorrow, but it may also hinder by giving an attitude or mode of attack not applicable" (p. 229). A practical

attitude on the subject of formal discipline is implied by the statement that, "Unless there is some specific contribution to be got from a study, I am not justified in studying it for such by-products as it may give me, for there are many other studies which are valuable in themselves and have the same by-products" (p. 238). Chapters XII and XIII are devoted to a review of the experimental work on fatigue and its relation to school work; and the influence of inheritance as shown in imitation, rivalry, the roving and collecting tendencies, play and education, manipulation. The final chapter devotes its space to the description of such elementary statistical methods as are helpful in conducting simple learning experiments.

The simple and direct style of the author and the absence of hair-splitting argumentation should make this a valuable text for students who are more concerned with making practical applications than they are in developing the theoretical principles underlying the learning process.

ALBERT P. WEISS

Ohio State University

NEALE, M. G. *School reports as a means of securing additional support for education in American cities.* Columbia, Missouri: The Missouri Book Company, 1921. 137 pp.

The primary aim is "to suggest a program of school reporting which will assist in securing for public education in the United States the increased support which the needs and opportunities of the present seem to demand." In carrying out this aim, two preliminary investigations were necessary, an historical study of school reports, and an examination of current city school reporting.

The first chapter is a careful study of source material for early school reporting in New England and in parts of the country later influenced by New England. The conclusion is that even in those early days school officials looked upon public school reports as more than mere accounts of how school officials had performed their duties. Even then publication was regarded "as a means of popularizing public education and of creating sentiment for better school equipment and conditions." The second chapter represents an exhaustive study of the facts about school reporting in American cities at present. The third chapter formulates a series of psychological principles and a detailed plan for reporting school facts to the public, which the investigation has shown to be desirable. Four appendices give respectively: extracts from state laws relative to city school reports, a copy of the questionnaire used in the investigation, a check table showing the particular kinds of school publicity materials used in all cities replying to the questionnaire, and a frequency table with descriptive titles of the charts and graphs found in 68 of the 103 school reports examined.

Dr. Neale went about his investigation in the only practical way, by collecting all the school publications he could and securing answers to a questionnaire from a satisfactory and thoroughly representative number of cities. The material was carefully worked up. Throughout, the reader has the impression that here is the book of a man who attacked his problem scientifically, knew his facts, and did a piece of school investigation that will not have to be done again.

The conclusions, in the light of the reviewer's special interest in this field for years, are thoroughly sound. Furthermore, they are so presented as to form a distinct contribution to our all too meager literature on effective school publicity.

The practical school superintendent of progressive inclinations cannot read this book without being given many new ideas and without being forcefully stimulated to a desire for effective school reporting in his own system. Whether he is seeking light on kinds of school publications, frequency of issue, size of type, illustrations, costs, or ideas for copy, the book will easily furnish satisfactory answers to such questions and to many similar ones. For students of school administration, the book has two values. In their period of training, it will serve future school executives much as it will active superintendents. It is also a model for conducting, summarizing, and presenting a good piece of scientific research in general school administration.

CARTER ALEXANDER

The Educational Finance Inquiry

News Items and Communications

This department will contain news items regarding research workers and their activities. It will also serve as a clearing house for more formal communications on similar topics, preferably of not more than five hundred words. These communications will be printed over the signatures of the authors. Address all correspondence concerning this department to Doctor E. J. Ashbaugh, Ohio State University, Columbus, Ohio.

Annual programs of the National Association of Directors of Educational Research will be given in the Congress Hotel February 28, March 1, and 2. The program of meetings will be found complete in the Association's Department of this issue.

Professor W. L. Carr of Oberlin College (Ohio) has announced an English Vocabulary test. Two forms will be available. Those interested in this type of test may secure copies from Professor Carr.

Superintendent E. C. Witham of Putnam, Connecticut, also announces an English Vocabulary test. The words were selected from Buckingham's Extension of the Ayres Scale and very brief definitions selected from Webster. The problem is one of matching definitions with words. Some of our readers may be acquainted with the Witham Silent Reading and Geography Tests.

Doctor Mason D. Gray, who is in charge of the Latin investigation of the Classical League reports that about one hundred schools are participating in the second part of the testing program. This means that they gave the preliminary test and are following with the second testing of the same pupils. Since satisfactory results are dependent upon from four to six testings of the same pupils, it is most encouraging to know that a very large proportion of the schools are maintaining the program.

Not a few cards are being devised for use in recording the results of tests. The general idea is to furnish an individual card which shall carry a cumulative record for each child throughout his school career. The most recent card of this sort which we have seen is one received from Chicago. It is a modification of the one which Mr. E. E. Keener used while he was superintendent of schools at Richmond, Indiana. This card is especially modern in its provision not only for scores but for ages and quotients—both achievement and mental.

Mr. W. H. Hughes, District Superintendent, Claremont, California, has sent us a students' comparative record card which he is using in his school system. This card contains on the face a place for the record of scholarship

for each semester in his six-year high school course and on the reverse a rating on a large number of items under the general headings of: Capacities and attitudes, special interest, and health and physical conditions. The card provides a five-step rating scheme upon which the child is given a rating on the basis of estimates of teachers and principals. A communication concerning some of the work which Mr. Hughes is doing in his schools will be found in the Department of the National Association.

Mr. Karl J. Holzinger of the School of Education, University of Chicago, has sent us a Correlation Form for the Product Moment Method which he states he has found helpful in his work. Professor Holzinger does not claim to have devised a new formula but rather that this form upon which data are to be recorded facilitates the computations and minimizes the chance for error. Several sheets of more or less similar nature have come to our attention recently. Any of these doubtless would be of service to teachers of statistics or to workers who find it necessary to have much of this type of work done by relatively untrained help.

County Superintendent A. G. Yawberg of Cleveland, Ohio, has just informed us that his office is proposing a series of monograph bulletins for the benefit of the schools of his county. The topics treated in these monographs are as follows: Program of studies, supervised study, lesson planning, proper use of the textbook, skill in questioning, economy in time of school room practice, skill in developing initiative, skill in motivating, skill in adaptation to individual needs, skill in making assignments.

A simple treatment of these topics based on the best results of constructive thinking and experiments which are available in the educational literature in scattered form will certainly be of great help to the educational force in Cuyahoga County.

We have received from the State Department of Education of Georgia a bulletin giving the definite results from the use of tests in the Dublin school system. The report is written by M. L. Duggan, Rural School Agent, and Euri Belle Bolton of the Extension Department, Georgia Normal and Industrial College. The Dublin school system was the first in the state to make a definite attempt to raise the standard of work as revealed by tests and to give tests a second time to measure progress. The first tests were given in December, 1920, and the second in May, 1921. The report presents the results in detail and should be very helpful to the Dublin schools. We hope that the bulletin may be distributed generously among the schools of the state and that a large number of schools may be stimulated to similar efforts.

Professor E. L. Holton, Kansas State Agricultural College (Manhattan), has presented us with some very interesting material which he is apparently using in an effort to teach the faculty of that school how to teach, and states that "our teachers are becoming very much interested in the problem of how

to teach." It seems that Professor Holton is offering a course for the faculties of the various divisions. The course includes the following general topics: nature of the learning process, forms of learning, general laws of learning, conditions and factors which favor learning, rate of learning and permanence of retention, individual differences in learning, stimulation to better scholarship, transference of training, formal discipline or general training, and learning for and through application.

It would seem to us that the faculty of any college, the members of which had not had a thorough grounding in psychology and the principles of education, would profit greatly by such a course.

The North Central Association of Colleges and Secondary Schools will meet in Chicago at the Sherman Hotel March 16, 17, and 18. This will be the 27th annual meeting. The commissions on Secondary Schools, Higher Institutions, and Unit Courses and Curricula will be in session on Thursday, March 16. The Commission on Higher Institutions will report at 10 o'clock Friday morning, March 17; the Commission on Secondary Schools at 2 o'clock in the afternoon. The Commission on Unit Courses and Curricula will report at 10 o'clock Saturday morning, March 18. President L. D. Coffman, of the University of Minnesota, will give the President's address on Friday evening. Statistical reports from all institutions will be required this year. The Commissions on Higher Institutions and on Secondary Schools will therefore have unusually important session and reports. The Commission on Unit Courses and Curricula which is doing important work on curricula organization, is also beginning a study of commercial school organization.

The pursuit of educational research is without end. The more one knows, the more one finds to learn. One problem is solved only to give rise to others which were not apprehended before. The superintendent who has made systematic use of the results of testing for purposes of classification finds himself confronted with a number of problems subordinate to the main problem of classification. These problems, though subordinate, are nevertheless exceedingly important.

Superintendent B. O. Skinner of Marietta, Ohio, has been classifying children on the basis of tests, but he has found that there are certain types of children in his schools whom the tests do not permit him to classify. These are the children who are suffering from nervous instability; who do well today and poorly tomorrow; who, in other words, may be expected to do anything except consistent work. These cases are largely pathological.

Superintendent Skinner is the victim of his own progressiveness. He feels the urgency of his new problem. But to all but a very few superintendents, the problem does not even consciously exist. Nevertheless, these erratic children are in every system. Perhaps we should recognize that in respect to them, our tests break down. Perhaps we should regard them as clinical cases. If anyone who has experience along this line will contribute something, we shall be glad to receive it.

"Welcome indeed," says P. T. Rankin of the Detroit Teachers College, "is any device that will give better organization for using the steadily increasing body of material in periodical form."

Mr. Rankin writes an exceedingly suggestive letter. He thinks it would be a great service if a standard classification of educational writings could be made up. Existing classifications are inadequate. The Dewey Decimal System for example, is silent on most phases of the virile and rapidly growing body of educational literature. The Bureau of Education has attempted a classification of the field which provides for about thirty divisions; but what we need is something very much more extensive than anything which has hitherto been brought out—something by means of which it may be possible to give every article and perhaps every important portion of an article a place so that at any time a reasonably complete bibliography within the scope of the material found in a given library may be assembled on any important topic. As Mr. Rankin points out, one reads in relation to present interests and perhaps catalogues the articles either mentally or in writing with reference to present purposes.

"Other relations are often neglected, and at some later time, when a new purpose, or group of purposes is dominant, one does not think to refer back to an article which may be relevant but which was not read in that immediate connection." We think Mr. Rankin has a splendid idea. Any research bureau which aims to be a service bureau also, needs such a system of classification.

The Testing Program in the State of Wisconsia for the Past Year[1]

The school officials of Wisconsin meet at Madison once each year and at that time vote on the type of tests which they wish to give during the year. It was in accordance with their wishes that tests were given in the following subjects:

In October the Monroe Standardized Silent Reading Test, and the Haggerty Intelligence Examination Delta 2 were given to the pupils just entering the ninth grade. It was decided to use Test 2 of the Monroe test in order to be able to ascertain just how bad the conditions were with those pupils who were backward in their ability to read silently. The results from 62 schools involving 7,039 pupils show that approximately one-third of those who enter high school fail to reach the sixth-grade standard as given by Monroe, while only 4 percent of the same pupils fall below the sixth-grade intelligence level. In other words, deficiency in ability to read silently can be ascribed to a lack of intelligence in only about 13 percent of the cases. We expect in a short time to send out mimeographed material giving rather detailed suggestions as to how to improve the silent-reading ability of ninth-grade pupils. We feel tha this is one of the most important problems which the high schools of Wisconsin are now facing.

The Monroe Silent Reading tests were also given in 24 counties involving 6,208 rural school pupils. The results showed that the rural children were also back-

[1] This communication was received from the State Department of Public Instruction of Wisconsin being kindly sent by someone too modest to sign his name. The carrying forward of the program this year is under the direction of Dr. W. J. Osburn, who is Director of Educational Measurements in the State Department.

ward in silent reading. Remedial exercises were sent out during the latter half of the year and much effort was devoted to ascertaining if it were possible to carry on a remedial program in one-room rural schools. In five counties where such programs were attempted a second test was given in April and May so that a measure of the amount of improvement could be obtained. The results were gratifying, and the rural teachers and supervisors were very enthusiastic over them.

The Woody-Theisen parallel tests in the fundamentals of arithmetic were given in both city and rural schools. In the rural schools, 27 counties participated involving from 4,000 to 5,000 children. Reports were also received from 19 cities involving from 3,000 to 3,500 children. In order to provide an intelligent basis for follow-up work, all the teachers who participated in the survey were asked to send in a list of the wrong answers which occurred at least twice. In that manner it was possible to secure a list of typical errors. This list has been reported to the school people of the state, and it is hoped that it will become a means of stimulating improvement of instruction in the fundamentals of arithmetic. Results on the Woody-Theisen parallel tests were also received from state graded schools[1] involving from 1,000 to 1,300 pupils. We also received reports from state graded schools on the Monroe Reading Tests representing 1,250 children.

The Hotz Algebra tests were given in 36 high schools involving from 1,100 to 1,600 pupils. These tests were given in March and April. There is a study of errors accompanying this test, and a list of typical errors has been compiled for algebra as measured by the Hotz tests.

Finally the Clapp Language test was given in 17 cities involving 3,000 pupils. The distributions were reported, together with the frequency with which each error occurred.

The children of Wisconsin made a good showing on all of the tests except that in reading. We are planning, therefore, to continue to devote much time and effort to the improvement of our instruction in this subject.

Composition Spelling Test

The rating of children in spelling according to the errors they make in spontaneously written compositions is well under way at Detroit. The course of study in spelling published for the Detroit schools sets up the method by which the testing of the children is to be carried out. The submission of a short composition to a number of teachers who were instructed to score the mistakes in spelling resulted in the identification of from six to eighteen mistakes according to the personal standards of the teachers in question. This condition led to the careful formulation of rules, set forth in the course of study, for rating papers.

There is derived from this type of testing what is called a Coefficient of Misspelling. The number of words of more than three letters are counted as well as the total number of words used in the composition. The total number of spelling mistakes divided by the number of words of more than three letters yields the coefficient of misspelling.

[1] These are small village schools of two or more rooms.

Returns from about 21,000 children in Detroit are reported in the January, 1922, number of "The Detroit Educational Bulletin." This report points out that although there is a steady increase in the total number of words per composition written in ten minutes as the children progress through the grades, there is an almost constant proportion of words of more than three letters. For example, in the eighth grade 50 percent of the words written contained more than three letters. In the third grade, on the other hand, the figure was 44 percent. Standard coefficients of misspelling are set up in writing the coefficients the decimal point is moved two places to the right. These coefficients ranged from 296.5 for the low third grade to 35.5 for the high eighth grade.

The idea of a coefficient of misspelling is interesting. It is one of the many interesting things which the Detroit people are proposing.

The Research Department at Los Angeles

From time to time the administrators of various cities who contemplate the creation of a bureau of educational research or who wish information upon which to base requests for additional support for the Bureau which they already have, send out letters of inquiry concerning the cost and function of such bureaus in other cities. In replying to such a request, Doctor Sutherland of the Department of Psychology and Educational Research of Los Angeles, California, has presented the situation in that city so clearly that we believe it is worth while to pass on the information to all our readers.

"This department now consists of a Director, Assistant Director, Assistant Supervisor, nine teachers and four clerks. The cost to the School Board for salaries is about $35,000; for supplies, $11,000; for equipment previously acquired, $3,000.

"The functions of the department are four-fold, Research, Supervision, Administration, and Instruction.

"1. *Research.* So far our research has been limited to class room instruction. We attack this problem from two points of view. From the administrative point of view we measure the results of teaching. We have not yet been able to cover the entire city through lack of funds. From the individual point of view we select those pupils who need better attention in order that they may spend their time profitably in the schools. We have yet to find a room in the school system which does not cover at least three grades when the actual performances of the children are considered.

"It is the function of this department to conduct research into every phase of school activity and it is anticipated this year that the board of education will set the research department outside of the machinery of the school system so that it may be in a favorable position to gather, for the superintendent and the Board, data regarding all phases of school activities.

"2. *Supervision.* At the present time this department has charge of the instruction in development rooms, adjustment rooms, and opportunity rooms. It has just turned over to another department the supervision of the special work with foreign children.

"3. *Administration.* The department has been burdened with a considerable amount of administrative detail and personal relationship. This has taken a good deal of time and might just as well be handled by the regular school man. We expect to correct this during the year.

"4. *Instruction.* Since normal schools do not train teachers and cannot train teachers because of the lack of actual school contacts it becomes the business of the public schools to conduct such training under supervisors and principals. This department has trained teachers to handle special work as other departments train teachers for their special lines. In connection with that training it has undertaken to conduct a great deal of research into the course of study. We have found that pupils, if properly taught, can make satisfactory progress in the higher grades if given only the minimum essentials in preparation for that work.

"The results of the work of this department may be indicated possibly by the following figures.

"Our per capita cost in the elementary schools is $81.94. A misfit and discouraged pupil who is not feeble-minded is taken into the special room and in ten weeks we can in some measure teach him how to study, enable him to cover at least a full year's work and pass on into a higher grade where thereafter he is a satisfactory pupil. These special rooms now accommodate over 1000 pupils. The turnover is four times a year. Therefore, you can see that the educational correction which we are doing is conducted at a cost of not over one-fourth the average per capita cost for the city.

"Since each grade is found to be an ungraded room in that each room houses pupils who can do satisfactory work in grades above or below that in which they are placed, we are faced with the fact that our public schools are woefully inefficient. We do not propose to measure everything but to measure accurately those things which are all ready being measured in the teachers' minds as a basis of promotion. This work is followed by instruction to the teachers which embraces the following points: (1) certain pupils need no teacher; (2) some pupils need a teacher part of the time; (3) some pupils need a teacher a good deal of the time; (4) the methods of study which the pupil acquires will be his study habits all the rest of his life.

A method of room organization is then taught to the teacher so that she can handle her work on that plan and it is working so successfully that the average pupil is proceeding at the rate of two years' work in a year without any sacrifice of special lines which are usually introduced into the rooms.

"Our Board of Education has recognized the effectiveness of our methods and has almost doubled our department this year, yet I assure you that we are completely swamped by the demands of the schools for more and more service."

Tests and Measurements in the Schools of Idaho

During the past and the present school years, the Bureau of Tests and Measurements of the Lewiston State Normal School has conducted a series of mental and educational tests in the schools of Idaho. The results are here summarized for three groups of schools. Class A schools are those meeting certain requirements as to num-

ber of teachers employed, extent of courses offered, etc.; the small city schools are those falling below these requirements; and the rural schools are the rural and consolidated schools of three counties. The tests in the city schools were all given by Professor C. L. Harlan or by the writer and the results were scored under their immediate supervision. It is believed that this uniformity of procedure has resulted in greater accuracy than would otherwise have been the case. The tests in the rural schools were given by or under the supervision of the county superintendents. A detailed report with interpretations of the results and recommendations for administrative action was returned to the superintendent of each school.

The results here reported are for the following tests: Haggerty Intelligence Examination, Delta 2; Monroe's Silent Reading Tests; and Monroe's Reasoning Tests in Arithmetic. Other tests, both mental and achievement, were given but not as extensively as the first three mentioned. The results are reported here, not with the idea that any new principle or method has been used or discovered, but to show the results for a state where the movement of tests and measurements is new, being now in its second year.

In Table I the results for the Haggerty Intelligence Examination are shown. It will be seen that both groups of schools fall somewhat below the grade standards. There is nothing in the character of the population that would lead one to expect this. On the contrary, the people of these communities are of a homogeneous high-grade American stock. It is possible that there is a difference in organization between these schools and the schools in which the tests were standardized. A more liberal policy of promotion, for example, would result in younger pupils, grade for grade, where such a policy is used. This in turn would result in lower median point scores. This factor may also account for the lower scores made by the small city schools as compared with Class A schools. The small number of cases in the former group should also be considered.

Table II shows a distinct superiority in silent reading of Class A schools over the other two groups. One would expect this on the showing made in intelligence. It is likely also that better teaching and a greater abundance of reading material in Class

TABLE I. RESULTS FOR IDAHO SCHOOLS IN HAGGERTY INTELLIGENCE EXAMINATION

	Grades						
	III	IV	V	VI	VII	VIII	Totals
CLASS A SCHOOLS							
Medians	33.4	55.7	74.2	88.8	102.3	115.0	
Number of Cases	348	796	731	726	697	559	3,857
SMALL CITY SCHOOLS							
Medians	33.5	47.6	68.8	87.4	105.2	110.8	
Number of Cases	58	95	103	104	59	72	491
Standard scores	40.0	60.0	78.0	96.0	110.0	120.0	

TABLE II. RESULTS FOR IDAHO SCHOOLS IN MONROE'S STANDARDIZED SILENT READING TESTS

	Grades						
	III	IV	V	VI	VII	VIII	Totals
CLASS A SCHOOLS							
Rate	46.6	66.1	82.7	91.6	104.4	115.2	
Comprehension	6.4	11.1	15.7	18.6	23.3	26.6	
No. Cases	1,015	1,739	1,558	1,498	1,435	1,275	8,520
SMALL CITY SCHOOLS							
Rate	37.8	56.3	69.8	81.1	97.5	100.7	
Comprehension	3.7	8.4	14.5	15.8	20.9	22.4	
No. Cases	222	264	241	220	181	188	1,316
RURAL SCHOOLS							
Rate	38.7	56.7	64.3	81.3	95.3	102.3	
Comprehension	3.7	7.3	12.5	16.6	18.8	20.9	
No. Cases	116	170	194	244	286	307	1,317
STANDARD SCORES							
Rate	52.0	70.0	87.0	90.0	100.0	106.0	
Comprehension	6.8	12.7	17.8	18.5	22.8	26.0	

A schools contribute to this superiority. It will be seen that the scores of Class A schools conform quite closely to the Monroe standards, some grades being somewhat below and others being slightly above standard.

In arithmetic, the scores of the three groups of schools are more nearly equal. When one considers that the teaching of arithmetic does not require as much material as the teaching of reading, a reason appears why the smaller schools are able to do as well as Class A schools. As was stated above, there is no reason for believing that the pupils of these three groups of schools differ materially in intelligence. A difference in the organization of schools is probably a factor in bringing the scores of the rural schools up to those of the city schools. A study of age-grade distribution of city and rural schools show a retardation of 35 percent for the former and 52 percent for the latter. This means that, grade for grade, the pupils of the rural schools are more mature than those of the city schools. Other things being equal, this should result in raising the achievement scores of the rural schools. An interesting sidelight may be thrown on the scores made by the eighth grades of the three groups of schools. In this grade, the rural schools surpass the other two groups. This result is probably attained by the efforts of the rural teachers to have their pupils make a good showing in the eighth-grade examinations which are given uniformly throughout the state.

In connection with a program as described above, the question is often asked as to whether it in any way affects teaching or administration in the schools. One of the most pressing problems in the schools of Idaho is the congestion due to a shortage of buildings. The testing programs frequently made possible special promotions which would tend to relieve the congestion somewhat. Much of the congestion is due to an

abnormal amount of retardation, being as high as 48 percent in some cities. When retardation ranges from this point to as low as 10 percent, it would seem that there is some need for more uniformity of organization. In one city school, a fifth A grade was found which received median scores, equal to or above those of the sixth B grade in intelligence, reading, arithmetic, spelling, handwriting, and language tests. Fifteen of the pupils of this fifth A grade were found to have the median ability, or better, of the sixth B grade. These pupils were accordingly given special promotion into the sixth B grade. Similar procedures were often found possible in other grades on a smaller scale.

TABLE III. RESULTS FOR IDAHO SCHOOLS IN MONROE'S STANDARDIZED REASONING TEST IN ARITHMETIC

	Grades					
	IV	V	VI	VII	VIII	TOTALS
CLASS A SCHOOLS						
Principle	9.0	15.2	13.2	18.7	14.6	
Correct Answer	5.2	9.2	7.9	12.9	7.2	
Number of Cases	865	864	772	802	640	3,943
SMALL CITY SCHOOLS						
Principle	8.3	15.9	14.5	18.1	15.1	
Correct Answer	3.9	9.3	8.3	12.9	9.1	
Number of Cases	135	125	136	100	113	609
RURAL SCHOOLS						
Principle	8.8	13.9	10.7	17.5	16.5	
Correct Answer	4.3	8.1	7.0	11.1	8.1	
Number of Cases	114	100	94	97	108	513
STANDARD SCORES						
Principle	9.6	17.0	15.5	20.7	16.8	
Correct Answer	5.3	9.7	10.2	14.1	9.4	

State Normal School, Lewiston, Idaho I. N. MADSEN

National Association of Directors of Educational Research

(E. J. Ashbaugh, *Secretary and Editor*)

TENTATIVE PROGRAMS FOR OPEN MEETINGS, TUESDAY, WEDNESDAY, AND THURSDAY AFTERNOONS, FEBRUARY 28th, MARCH 1st, MARCH 2nd, GOLD ROOM, CONGRESS HOTEL, CHICAGO

TUESDAY, FEBRUARY 28

RESEARCH IN MENTAL AND EDUCATIONAL MEASUREMENT

PRESIDENT HAROLD A. RUGG, PRESIDING

1. Results Obtained by Classifying 2,000 Kindergarten Children by Means of the Binet Test. Charles D. Dawson, Assistant Superintendent of Public Schools, Grand Rapids, Michigan.
2. Research vs. Propaganda in Visual Education. Frank N. Freeman, Professor of Educational Psychology, University of Chicago.
3. Evaluation of Group Intelligence Tests. Raymond Franzen, Director of Research, Public Schools, Des Moines, Iowa.
4. A Study of Reading and Spelling with Special Reference to Disability. Arthur I. Gates, Assistant Professor of Educational Psychology, Teachers College, Columbia University.
5. Studies of Anticipation of Meaning in Reading. C. T. Gray, Professor of Educational Psychology, University of Texas.
6. New Experimental Investigations in Reading. Guy T. Buswell, Assistant Professor of Education, University of Chicago.
7. Intelligence and Progress Through the Grades. Arthur W. Kallom, Assistant Director, Educational Investigation and Measurement, Boston Public Schools.

WEDNESDAY, MARCH 1

RESEARCH ON THE CURRICULUM AND SCHOOL PROGRESS

DOCTOR LOTUS D. COFFMAN, PRESIDING

1. Curriculum Construction in an Experimental School. Otis W. Caldwell, Director, Lincoln School of Teachers College, New York City.
2. Comparison of Reading, Writing, and Pre-School Spoken Vocabularies. Ernest Horn, Professor of Education, University of Iowa.
3. Curriculum Construction in the Commercial Field. W. W. Charters, Carnegie Institute of Technology.
4. Relation of Measurement to Pupil Progress and Curriculum Research in Reading. Laura Zirbes, Special Investigator in Reading, The Lincoln School of Teachers College.
5. Temperament and Attitude as Factors in School Progress. Clara Schmitt, Bureau of Child Study, Chicago Public Schools.

THURSDAY, MARCH 2

PROGRAM OF RESEARCH IN SCHOOL ADMINISTRATION
DEAN CHARLES E. CHADSEY, PRESIDING

1. A New Supervisory and Administrative Organization for Public Schools. P. C. Packer, Professor of School Administration, University of Iowa.
2. Educational Measurement as a Key to Individual Instruction and Promotions. Carleton W. Washburne, Superintendent of Schools, Winnetka, Illinois.
3. Qualities Related to Success in Elementary School Teaching. Frederic B. Knight, Assistant Professor of Educational Psychology, University of Iowa.
4. The Sociological Character of the Secondary School Population. George S. Counts, Associate Professor of Secondary Education, Yale University.
5. Methods of Investigation in the Field of Educational Finance. George D. Strayer, Teachers College, Columbia University; Director of Educational Inquiry.

TENTATIVE PROGRAMS FOR CLOSED MEETINGS, WEDNESDAY AND THURSDAY MORNINGS, MARCH 1st AND 2nd. PLACE TO BE ANNOUNCED. FOR MEMBERS ONLY.

I. Wednesday morning meeting. General Topic: A Clearing House of Educational Research Now Under Way Throughout the Country.

Informal five minute talks will be made presenting succinctly examples of research in all fields of education: mental and educational measurement, curriculum studies, learning investigations, classification of pupils, school finance, school buildings, programs, promotions, etc. The president desires to receive from each member of the Association a brief outline of the research which he will report at this meeting. We should have not less than 20 such reports. Persons have been designated in the different research and training institutions to make reports of research under way in these places. The meeting is organized for the purpose of acquainting us with what our colleagues are doing, to clear our minds as to the direction in which we are moving and to set forth the strength and weaknesses of our present research practice.

II. Thursday morning meeting. General Topic: The Preparation and Publication of Products of Educational Research.

Eight or ten papers and reports will be prepared to discuss crucial issues of educational writing. The purpose of the conference is two-fold: (1) the improvement of educational writing; and (2) the encouragement and stimulation of research workers to publish in effective channels, and in appropriate form, the results of their research.

ANNUAL DINNER, 6:30 THURSDAY EVENING. PLACE TO BE ANNOUNCED. FOR MEMBERS AND INVITED GUESTS.

1. Presentation by executive committee for election to honorary membership: Dean James E. Russell, Teachers College, Columbia University, and Dr. G. Stanley Hall, President Emeritus of Clark University.

2. Annual Address of Retiring President: The Methods of Science in Educational Research. Harold O. Rugg, The Lincoln School of Teachers College.

Iowa State Teachers College.—Professor Fred D. Cram is doing extended work in testing and measuring in the Rural Schools of Iowa for the Rural Education committee of the National Council of Education. We are sure that those interested in rural education will look forward eagerly to a report of this committee.

Omaha, Nebraska.—Assistant Superintendent L. O. Smith writes us that the contract has recently been let for the construction of a new technical high school which will cost approximately $3,000,000, and which will be one of the very finest school buildings in the whole country.

In the test field he states that they have given the Kirby Grammar Test to the eighth grade, Courtis Series B to grades five to eight, Monroe Silent Reading to grades three to eight, the Pressey Primer Scale to the third grade, and the National Intelligence Test to grade eight.

New York State Department of Education. Mr. J. Cayce Morrison, Specialist in Educational Measurements, has sent us a report of regional conferences on educational measurements which the State Department held this past fall. The report is so full of suggestions to state school administrators that it will be given in full in the Department of News Items and Communications. We do this in the hope that it may receive wider reading there than in our own department.

Roslyn, New York. Superintendent James B. Welles reports that he is just completing a detailed study of the school history of every child now in school and of every child who was in the first grade twelve years ago or eight years ago. Where school records have been adequately kept such detailed studies of the educational history of our children are of very great value. Unfortunately a large proportion of our school systems throughout the country do not have adequate records extending over such a period of time.

Claremont, California. W. Harden Hughes, District Superintendent, is carrying forward some interesting work with his student body. In a recent letter he says, "we are trying to carry out, on a somewhat elaborate scale, a type of human accounting in which we are taking into conscientious consideration the informal elements of a real education. Every student, in going through our junior-senior high school will be rated by approximately 25 or 30 teachers

under whom he receives instruction. The final rating of the students each year is based upon the ratings of all his teachers, on the observations of his principal, and on the results of a number of standardized tests."

Superintendent Hughes states that he is using the term "scholarship probability" instead of the ordinarily used Intelligence Quotient. "When we call them (the quotients) what they really are we eliminate very much danger and at the same time make them much more useful in educational administration. With the interpretation that we now put on these so called intelligence tests I can show the results even to a parent whose child has made less than a normal score without taking chances of being whipped."

"We are making a general study of the improvement which is taking place in the teachers' methods as a result of the emphasis we are placing on the human factor. We are emphasizing in the requirements for super-credit marks, those habits, attitudes, and other characteristics which the world of affairs is eager to discover in her workers and upon which she places a high premium."

Kansas City, Missouri. Assistant Superintendent George Melcher reports that the Research Department is continuing to expand and demonstrate its value. This year they have in progress a high school experiment in the outcome of which our members will doubtless be greatly interested.

"In one of our high schools, we tested about 800 freshmen, using the National Intelligence Test, the Terman Group Intelligence Test, and the Monroe Silent Reading Test. We of course had access to the grades which the pupils had made in algebra and in English. We also asked each English teacher to estimate the intelligence of her pupils as 'very bright,' 'bright,' 'average,' 'dull,' 'very dull.' We made the same request of each algebra teacher. We also had each algebra and each English teacher estimate the ability of her pupils to interpret English as 'very excellent,' 'average,' 'inferior,' 'very inferior.'

"These data were collected and correlations carefully figured. We then selected from these pupils two superior groups for English and two for geometry. The two superior groups in geometry will do plane and solid geometry during the regular school year, or 50 percent more than the usual work. The English class will not cover 50 percent more work but will be given an enriched course. One inferior group in each subject was also selected.

To date, which is not the middle of the year, no transfers have been made from the superior groups in English. However, from the two superior groups in geometry, five transfers have been made to the average group. These transfers were necessary, investigation showed, not because the pupils did not have the mental ability to carry the heavy load in geometry, but because they were overloaded with extra-classroom activities and social duties. The pupils of their own volition, prefered to move at a slower rate in geometry and to have more time for other activities."

State Normal School, Emporia, Kansas.—A letter lately received from Dean A. Worcester, acting Director of the Bureau of Educational Measurements and Standards, Kansas State Normal School, Emporia, Kansas, states a problem which has been

voiced by some of our friends at different times. It is therefore presented here in the hope that the members of our association will consider the question seriously and formulate in their own minds the answer which the Association should make officially upon this topic. Mr. Worcester says:

"In the Journal of Educational Psychology for October, 1921, Franzen and Knight in an article entitled "Criteria to Employ in the Choice of Tests" have called attention to facts, very familiar to us, that the average administrator is becoming very much confused among the multiplicity of tests in his attempt to choose the right one. The authors of the above article have, I think, well pointed out the various criteria which go to make up a good test,—for example, that it measure what it pretends to, that it measure reliably, that it be objective, that it have good norms, etc., etc. It seems to me, however, that all this does not help the administrator very much. Just what means does he have of knowing whether or not a test measures what it purports to measure? Or how does he know that it will yield the same diagnosis tomorrow that it does today? It is of course obvious that he can not secure tests and try them out experimentally before using them seriously in his schools. It is true that he may look at the advertising material for a given test and see whether or not it lays claim to these virtues; but I imagine you will find that most of them do claim directly or indirectly to possess all these good qualities, although we all know that they do not possess them in anything like equal degrees.

"It seems to me therefore, that there ought to be some group or organization which will carefully scrutinize the various tests offered and publish critical reviews of them to the end that the administrator may choose widely. The testing movement depends for its success, it seems to me, not so much upon the number of tests used, as the number which give good results. Could not the National Association of Directors of Educational Research accept this critical activity? I realize that there are certain very practical difficulties in the way, that there is always a feeling of professional courtesy which prevents one from offering criticism which will hurt another's pocketbook; and I realize the further difficulty involved in the elaborate organization which might be necessary in order to test out all the tests offered. It does seem to me, however, that something should be done by systematically reviewing tests in, for example, the JOURNAL OF EDUCATIONAL RESEARCH, as we review books. I note, for example, in the current number of this journal which has just come to hand a review of Wilson and Hoke's "How to Measure" by Ashbaugh which frankly takes up the weak points of that book. Why would we not have an equal right to point out as frankly the weak points of any given test? If we are convinced that a given test does not measure what it is to measure it seems to me we could set that fact out with clearness and at the same time be doing a great service to school administrators all over the country. It is my notion that an organization attempting to do this could very well advertise itself to school people as being the place from which they could get expert advice as to the use of tests. I realize that they can and do get certain advice now by writing to the various bureaus of educational research; but the present tendency of book companies to enter widely into the field of distributing tests and to flood superintendents and principals with advertising matter concerning them will, I fear, tend to lessen the direction of testing by bureaus such as ours and put it in the hands of the best advertising book company."

It will be of interest to the members of the association to know that this matter was brought before the executive committee at its meeting in September; but the com-

mittee felt that it ought not to act upon such a matter without having the advice of the members of the association, who have had an opportunity to think over the matter very carefully before expressing an opinion. The publication of this communication at this time should give the members of the Association ample opportunity to consider the question from all angles and to be prepared to discuss intelligently the merits of the question at our meeting in Chicago. The executive committee will welcome communications from members of the Association relative to this question.

COMMITTEE TO APPRAISE STANDARD TESTS?

Do we want it? If it can be honest, scientific and practical—yes! If it is to promote some existing "bloc" of test promoters—No!

One of the working principles of such a committee should be that no test should be denounced until it has been carefully tried out.

How would such a committee be appointed? To whom would this committee be responsible? The education of the masses is intrusted to school superintendents and their teachers. How much will they have to say about this committee?

If the chief function of such a committee is to protect superintendents, then, "forget it," and give the time and effort to more useful pursuits. Superintendents are quite capable of judging for themselves whether a test is pedantic or practical.

On the other hand, if such a committee could be broad gauged, realizing that at the end of the first decade of tests and measurements there are no savants, and that so far only a beginning has been made, but that that beginning, with all its defects, has been a very important one,—with such a conception plus an honest desire to render service, such a committee would be a very desirable thing.

ERNEST C. WITHAM

Supt. Schools, Putnam, Conn.

[The above reply from Superintendent Witham is the only one that has come to us as a result of the invitation printed in the January number. (Page 83). We print it in full in order that our readers may get Superintendent Witham's reaction to the situation. Since this matter will come before the Association for discussion at one of the closed sessions, it is hoped that a large number of our members will be ready to express themselves on the proposition at that time.

We would like to call attention to one fact. No one is entitled to be considered an expert in any field because of the position which he holds. Expertness is an attribute derived from unusual knowledge and not from position held. The statements which we have received from large numbers of superintendents would indicate that a great many of them at least feel the need of guidance in the field of tests.

EDITOR.]